







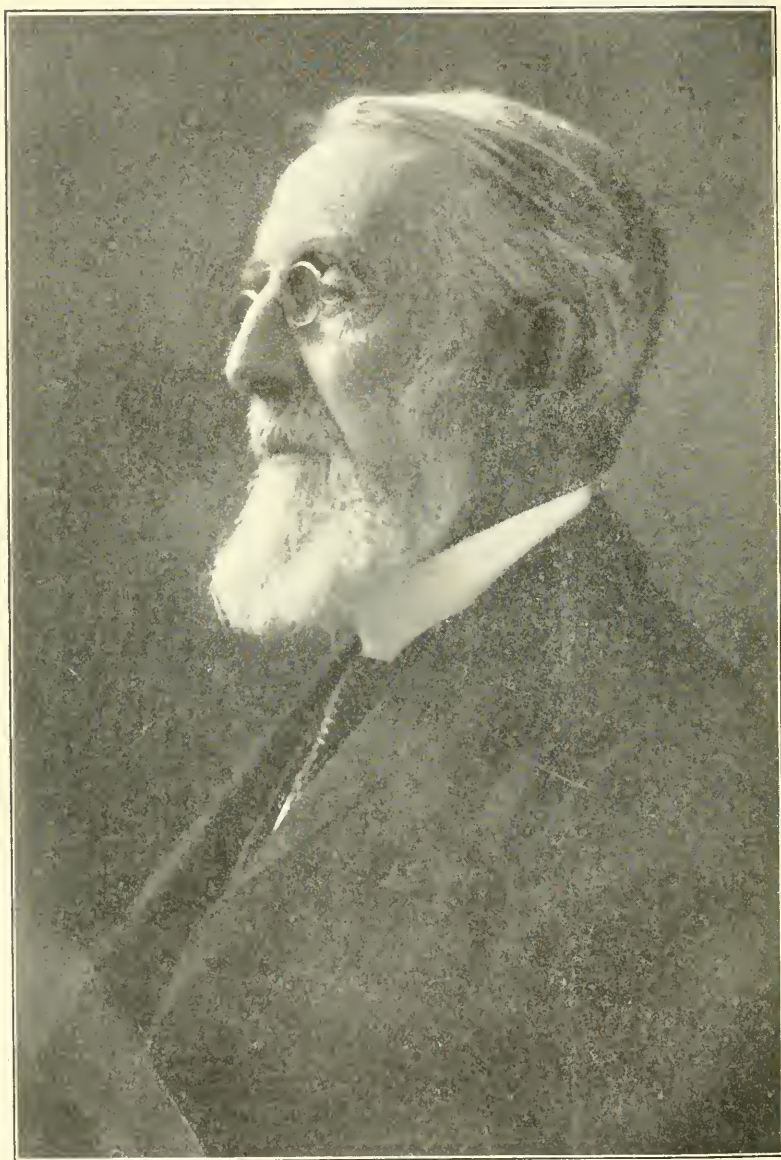






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Andrew Dickson White

*By courtesy of White Studio*

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# THE CORNELL CIVIL ENGINEER

AND

## Transactions of the Association of Civil Engineers of Cornell University

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### In Memoriam

#### ANDREW DICKSON WHITE

On November 4, 1918, after an illness of several days following a slight paralytic stroke, Hon. Andrew D. White, President of Cornell University from its foundation until 1885 and faithful friend, counselor and Trustee to the last, passed away at his residence on East Avenue. He was laid to rest in the Memorial Chapel next to his co-laborer, Ezra Cornell, on the eighty-sixth anniversary of his birth.

Little could be added to the well-merited tributes from eminent men the world over which have already been published; yet Cornell civil engineers, realizing that his special interest lay in other lines, proudly acknowledge a great indebtedness to him whose ideas and ideals regarding scientific and technical education fitted so admirably into Mr. Cornell's idea "To found an institution where any person can find instruction in any study;" whose remarkable acumen gave to the College of Civil Engineering that splendid triumvirate of professors, Fuertes, Crandall and Church and whose vigorous and able interest, watchfulness and co-operation contributed so much to the development of civil engineering instruction at Cornell.

Andrew D. White was born on November 7, 1832, at Homer, N. Y. and lived there until seven years of age when the family moved to Syracuse where his father became a leading banker. Andrew attended the Syracuse Academy and St. Paul's Parish School and was then sent to Hobart for one year. Conditions there were very distasteful to him and he finally won his father's consent to enter Yale, where he graduated in 1853.

He then spent three years in study and travel in Europe, returning in 1856 and accepting a professorship of history and English literature

at the University of Michigan in 1857. In 1863, business reasons having led to his return to Syracuse, he was elected to the New York State Senate, where he soon came into contact with Ezra Cornell. The meeting was providential as it led finally to the founding of Cornell University, the charter for which was obtained on April 27, 1865. Mr. White was a trustee from the first and drew up the plan of organization. He was elected its first president on October 21, 1866, and served continuously until 1885, except for two years, 1879-81, when he was Minister to Germany and Vice-President William Channing Russell acted in his stead.

Mr. White was Minister to Russia from 1892 to 1894 and a member of the Venezuela Commission in 1896-7. From 1897 to 1902 he was Ambassador to Germany. He also served as president of the American delegation to the First Hague Peace Conference in 1899. He took an active interest in university and public affairs to the last and only last summer spent several weeks in Washington, acting part of the time as special adviser to President Wilson.

Dr. White was the recipient of many honorary degrees from both American and European universities and was a member of many clubs and associations. He was also the author of many books, articles and addresses.

Thus as author, educator and diplomat, he has left an enduring and enviable record, but as the first president of Cornell University and the inspiring exponent of the Cornell idea, he will continue to live in the hearts of all Cornellians.

# THE USE OF SEMI-LOGARITHMIC PAPER IN THE DETERMINATION OF EMPIRICAL FORMULAS

E. W. Lane, C.E., '14

The use of logarithmic paper in the determination of equations to represent the results of experiments has become widespread. While many curves can be closely fitted by a straight line on logarithmic paper, better agreement is often secured with the aid of semi-logarithmic paper. All curves represented by a straight line on logarithmic paper have, when plotted on rectangular co-ordinates, either two asymptotes or none at all. The semi-logarithmic paper fills the gap between these two curve types, by providing for those with one asymptote.

## CHARACTERISTICS OF SEMI-LOGARITHMIC PAPER

While semi-logarithmic paper is on the market, its characteristics are not so familiar as those of logarithmic paper and a short explanation of its principal properties may assist in an understanding of its use.

Figure 1 represents a typical semi-logarithmic system of co-ordinates, in which the  $y$  axis is divided according to a logarithmic scale, while the  $x$  axis is divided into spaces of equal length. The equation of the line  $J''L''$  instead of being

$$\log y = n \log x + \log C \quad \text{or } y = Cx^n$$

as would be the case on logarithmic paper, is

$$\log y = nx + \log C \quad \text{or } y = C K^{nx}$$

where  $K$  is the base of the system of logarithms used (usually 10),  $n$  is the algebraic slope of the line, on the semi-logarithmic paper, with respect to the equally divided ( $x$  axis and  $C$  is the value of  $y$  where the line cuts the logarithmically divided  $y$  axis. In Figure 2, the equation of the line  $M''N''$  is

$$x = C'K^{ny}$$

In the use of semi-logarithmic paper the determination of the value of  $n$ , or the algebraic slope of the line, is usually more complicated than with logarithmic paper, due to the difference in scale of the divisions along the two axes of most semi-logarithmic papers. Since the logarithm of 1 is 0, of 10 is 1, and of 100 is 2, the unit distance along the logarithmically divided axis is the distance between the lines marked 1 and 10, or 10 and 100. On most semi-logarithmic paper this is a much longer distance than from 0 to 1, or 1 to 2 on the equally divided axis. Therefore, to obtain the algebraic slope, the measured slope must be corrected according to the ratio of these two distances.



## TYPES OF SEMI-LOGARITHMIC CURVES

The types of curve for which equations can be readily found by the aid of semi-logarithmic are eight in number. They may be divided

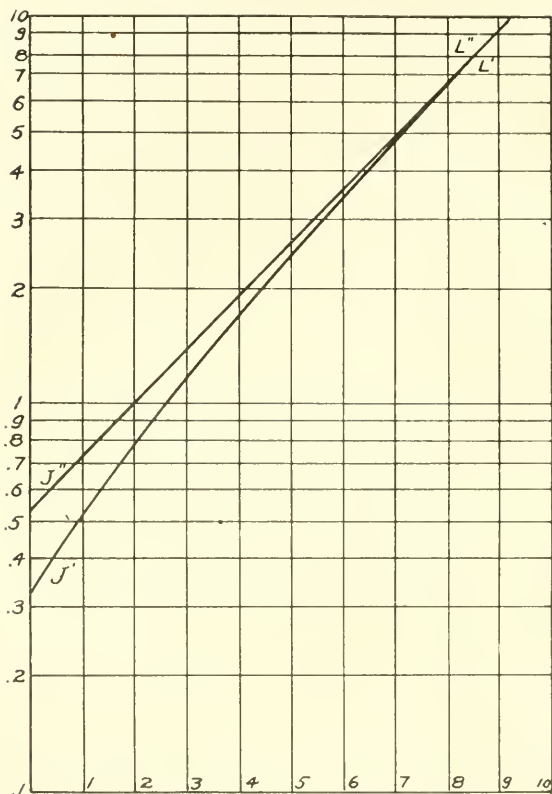


Figure I.

into four classes, according to their shape when plotted on rectangular co-ordinates. Each class contains all the curves having a slope of the same sign and being concave in the same direction. These curves have equations of one of the following four types:

$$\log (A-y) = nx + \log C \quad \text{or} \quad (A-y) = CK^{nx} \quad (\text{I})$$

$$\log (A-x) = ny + \log C \quad \text{or} \quad (A-x) = CK^{ny} \quad (\text{II})$$

$$\log (y-A) = nx + \log C \quad \text{or} \quad (y-A) = CK^{nx} \quad (\text{III})$$

$$\log (x-A) = ny + \log C \quad \text{or} \quad (x-A) = CK^{ny} \quad (\text{IV})$$

Table I lists the properties of the various curves and the equations which determine them. For example: a curve of the shape included

in Class *B*, which has an asymptote parallel to the axis of *x*, has an equation of the form

$$y-A = CK^{nx}, \text{ where } n \text{ is positive.}$$

If, however, the asymptote is parallel to the axis of *y*, the equation is of the form

$$A-x = CK^{ny}, \text{ where } n \text{ is negative.}$$

#### APPLICATION TO EXPERIMENTAL RESULTS

The method of determining the equation of curves by means of semi-logarithmic paper is as follows: Suppose *M N* (Fig. 3) is the curve




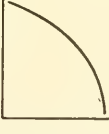
Class	Type of Curve	Equation Type	Sign of "n"	Asymptotic to
A		I	-	$y=A$
		IV	+	$x=A$
B		III	+	$y=A$
		II	-	$x=A$
C		III	-	$y=A$
		IV	-	$x=A$
D		I	+	$y=A$
		VI	+	$x=A$
<p><i>Types of Equation</i></p> <p>I <math>A-y = CK^{nx}</math></p> <p>II <math>A-x = CK^{ny}</math></p> <p>III <math>y-A = CK^{nx}</math></p> <p>IV <math>x-A = CK^{ny}</math></p>				

Table I.

for which an equation is desired. An examination of Table I shows that it is of the Class *B* and, therefore, its equation is either of the form

$$y-A = CK^{nx}, \text{ where } n \text{ positive (Type III)}$$

or of the form

$$(A-x) = CK^{ny}, \text{ where } n \text{ is negative (Type II)}$$

The curve seems to have an asymptote at  $x$  equal to about 10 and since the curves of the second of these forms are asymptotic to the line  $x = A$ , its equation is probably of that form.

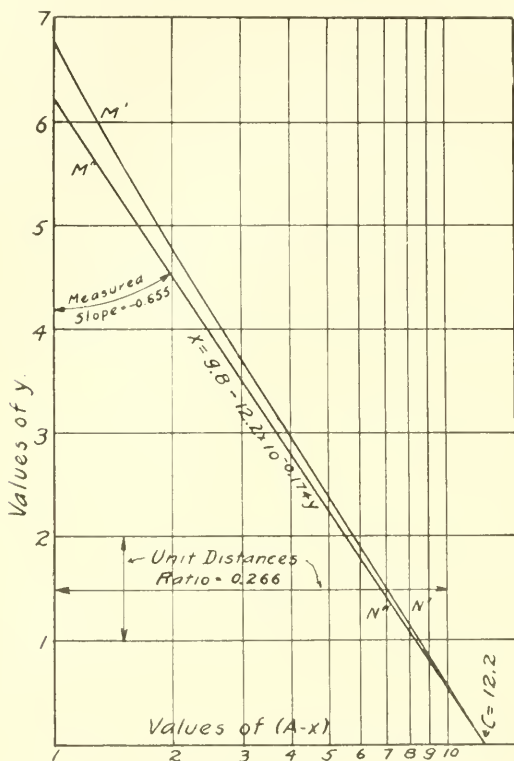


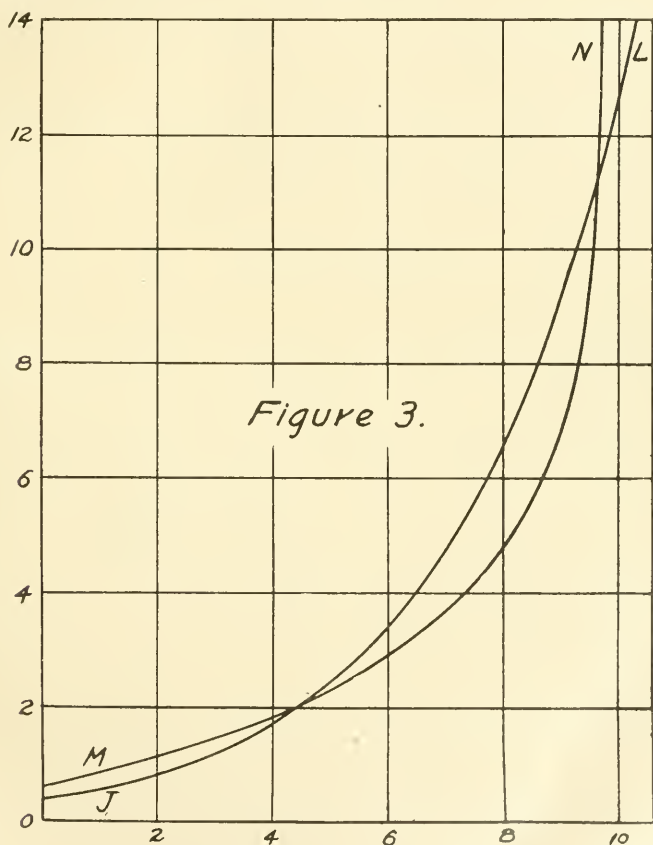
Figure 2.

#### DETERMINATION OF A

The equation of the curve is found by determining, by a cut and try process, that value of  $A$  which will cause the values of  $A-x$  to fall on a straight line, when plotted against the corresponding value of  $y$ . Since the curve seems to be asymptotic to a line  $x$  equal about 10,  $A$  must be approximately equal to 10. For the first trial, therefore, we will plot  $A-x$  along the  $x$  axis against  $y$ , assuming  $A = 10$ . This gives the curve  $M'N'$ , (Fig. 2) which is nearly a straight line. The shape of the trial curve indicates the nature of the necessary change in the approximate value of  $A$  to produce a straight line. If we decrease the assumed value of  $A$  slightly, the values of  $(A-x)$  for each value of  $y$  will be reduced by the same increment. At the right hand side of



the sheet, however, this increment is represented by a much smaller distance than at the left-hand side, and the curve is moved further toward the left side of the sheet and therefore becomes more nearly straight. If we assume  $A = 0.8$ , the curve takes the position  $M''N''$ , practically a straight line. The equation of the curve  $MN$ , is therefore  $\log(0.8 - x) = ny + \log C$ , or  $(0.8 - x) = CK^{ny}$ . By keeping in mind that the part of the curve having the smallest values on the logarithmically divided axis, makes the greatest change of position with any change of the assumed value of  $A$ , a little practice will enable one to rapidly arrive at an accurate value of this constant.



DETERMINATION OF "n"

The value of  $n$ , as has already been explained, is the algebraic slope of the line with respect to the equally divided (in this case  $y$ ) axis. The actual slope, or the tangent of the angle, the line makes with the  $y$

axis, will be found by measurement to be  $-0.655$ . The unit distance is different along the two axes. The ratio of the length of the unit distance (from 0 to 1) along the  $y$  axis, to the length of a unit distance (1 to 10) along the  $x$  axis being  $0.266$ , the algebraic slope of the line is therefore  $-0.655 \times 0.266 = -0.174$ , and the equation of the curve  $MN$  is;  $\log (0.8 - x) = -0.174 y + \log C$ .

#### DETERMINATION OF C

The value of  $C$  can usually be readily found from the curve, since it is the value (12.2) on the logarithmically divided axis, at which the line cuts that axis. The equation of the curve is therefore;  $\log (0.8 - x) = -0.174 y + \log 12.2$  or  $x = 0.8 - 12.2 \times 10^{-0.174y}$ . In case it is impractical to continue the line to this axis, the value of  $C$  can often be computed as follows. In the above equation, since the logarithm of 1 = 0, if  $(0.8 - x) = 1$ ,  $\log (0.8 - x) = 0 = -0.174 y + \log C$ ; whence  $\log C = 0.174 y$ . From the curve, when  $(0.8 - x) = 1$ ,  $y = 6.2$  and therefore  $\log C = 0.174 \times 6.2 = 1.080$  or  $C = 12.2$ .

#### ANOTHER EXAMPLE

Or consider the curve  $JL$  which is also in Class B. Since it appears to have an asymptote parallel to the  $x$  axis, it probably has an equation of the form  $(y - A) = CK^{-ny}$  (Type III) where  $n$  is positive, in which  $A$  is approximately zero. Plotting, on semi-logarithmic paper, the values  $(y - 0)$  of points of the curve, against the corresponding values of  $x$  gives the curve  $J'L'$ . By trial it will be found that by assuming  $A = -0.2$  instead of 0, which is equivalent to moving the curve upward 0.2 spaces, makes the plotted points fall on a straight line. The slope of this line with respect to the  $x$  axis is 1.04, the ratio of the unit distance along the two axes is 0.134 and the value of  $n$  is therefore  $1.04 \times 0.134$  or 0.139. The equation of the curve  $JL$  is therefore  $y = C \times 10^{0.139x} - 0.2$ . As in the preceeding example,  $C$  may be found to be 0.527 and hence the equation is  $y = 0.527 \times 10^{0.139x} - 0.2$ .

If greater refinement is required than can be obtained on the commercially ruled semi-logarithmic paper, the values of  $\log (A - x)$  may be plotted against the values of  $y$  on rectangular co-ordinate paper, to any desired scale. Although the use of semi-logarithmic paper in the determination of equations is somewhat more complicated than that of logarithmic paper, there is no reason why, when its use has become familiar to engineers, semi-logarithmic paper should not prove to be nearly as useful as logarithmic paper has become.

# EMPLOYMENT BUREAU CLASSIFICATION METHODS

System developed by Registration Bureau of the Cornell Society of  
Civil Engineers of New York

## PUTTING THE RIGHT MAN IN THE RIGHT JOB

C. S. Rindfoss, C.E., '06, Chairman Registration Bureau

In view of the large number of engineers in the Military and Naval service of the United States who will soon be candidates for positions in civil life, and in view of the awakening interest that is being manifested by various organizations in the scientific placing of men in positions which they are, by training and temperament, qualified to fill, the methods of the Cornell Society of Civil Engineers may be of considerable interest. That the question of securing work for discharged soldiers and sailors is being seriously taken hold of is evidenced by the many bureaus being established with this as one of the main objects in view. Such a bureau for professional men is being organized by the Employment Bureau of the Department of Labor, known as the Professional Division. Likewise the American Society of Civil Engineers is organizing a similar bureau. The various college bureaus are also showing renewed interest. The writer believes, however, that important as is the question of assisting the unemployed, in which class discharged soldiers and sailors would fall, there is one possibility of service on the part of such bureaus of much greater and abiding importance, namely, the shifting of the man who is doing unprofitable, uncongenial or unsatisfactory work into work that he can do to better advantage; in short, in helping the "misfits".

Nothing is more sad than to see a man doing work for which he is not fitted. Many men start on the wrong path or become sidetracked and, being burdened with a family or other private responsibilities, lack the time, capital, ability, or nerve to change to that position where their native talents have a chance to display themselves. A helping hand at this juncture pointing the way to greater opportunities, is a fine thing not only for the man but for the professions and society in general, tending to efficiency and greater productiveness.

Keeping this in mind, the first step in the plan of the Cornell Bureau was to catalogue every man who had ever attended the college whether he was satisfactorily employed or not, whether he was a beginner or a man of high attainments. A questionnaire, was sent to every Cornell Civil Engineer, some two thousand in number. The idea in cataloging all the men was; first, that in no other way could it be determined how many were desirous of a change; second, that any man at any time

might become a candidate for a new position; third, that every man, practically speaking, will consider a change if offered sufficient inducement either in salary, responsibility or chance for service; and fourth, that the sympathy and help of the satisfied men was necessary to the bureau and that they would support a bureau more readily if they were a part of it and received the various notices sent out from time to time.

These questionnaires are four pages, letter size and are filed by number (without reference to the alphabet). All correspondence with reference to a man's record received subsequently is filed with the questionnaire, so that the questionnaire becomes a folder with complete data—up-to-date—and immediately available. Follow up cards are sent from time to time to keep the records up-to-date and these also go into the questionnaire folder.

A card index (size 3x5) is maintained to go with the questionnaires, arranged alphabetically each card containing the name of the man and his number,—nothing more. By means of this index, given a man's name, his number can be immediately determined and from the number his questionnaire is located.

Another card index (size 3x5) is maintained which is arranged by classes. This index is divided into two main groups labeled "satisfied" and "not satisfied". Unemployed men are filed in the latter group until employed when their cards are transferred to the "satisfied" group. Should a man become dissatisfied with his employment, his card is transferred from one group to the other without disarranging the regular files.

Each of the two main groups is sub-divided by salaries. For example, cards of all men who place a value on their services of say \$250 per month are placed between the tabs 200 and 300. Men who value their services at, say \$350 have their cards placed between the tabs 300 and 400, and so on. Should a man's value increase so that his subsequent reports show that, whereas at one time he would consider a \$250 position and his card was so filed, he now would consider nothing less than \$350 his card is simply transferred without deranging the regular files.

Each salary group is further sub-divided by symbols which indicate whether a man is a candidate for an "Executive", "Administrative", "Engineering", "Sales", "Clerical", "Commercial", etc. position. The card is so ruled that the symbol and salary may be changed from time to time so that without even knowing what the symbols mean the card can be placed in the right slot by a clerk with a maximum of speed and accuracy. For example, if the last symbol on a card is 1-450-NS his card belongs in the "Not satisfied" group, sub-division 400-500

(salary) sub-sub-division (executive). Further reference to the questionnaire here illustrated will show the basis of the classification on these cards.

The procedure in practice in using the file would be about as follows: Suppose an employer calls for a man to fill the following position

1. Superintendent of construction.
2. Salary—\$450 per month.
3. Age wanted 30-40.
4. Type work—Factory building.  
Reinforced concrete.  
Pile foundation.

It would require but a moment to pick the group of cards classified Administrative—400-500. The corresponding questionnaires are then taken from the questionnaire file and those selected which represent men of about the age and professional attainments required. Any special requirement such as "married man preferred," "man capable to design as well as construct wanted," etc. can be determined from the questionnaire. An exact copy of each questionnaire of each logical candidate is then sent the employer and the original returned to the file. A metal signal is then placed on the card of each man recommended for purposes of "follow up". A notice is also sent to each man telling him he has been recommended for the position.

It will be seen that every effort is made to serve the employer by only sending "logical" candidates. If no man seems available, the inquiry is referred to one of the other college bureaus who reciprocate in like manner.

Many other forms and devices for follow-up purposes, for obtaining inquiries from employers, and to save dictation in correspondence, are used but it is thought the method here explained gives the gist of such features as are novel. The plan was evolved after a careful study of many other systems and it is believed that by combining good points from several with ideas of our own, a good workable system has resulted.

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NOTE. An illustration of the form of questionnaire, used has not been included, as one has already been sent to the majority of the Alumni. Questionnaires may be obtained from the office of the Bureau, located at Room 916, 30 East 12nd Street, New York City.





Adelbert Philo Mills

*By courtesy of White Studio*

## DIED IN SERVICE

ADELBERT PHILO MILLS, B.S., M.S.

DIED AT BREST, FRANCE,

OCTOBER 20, 1918

In the death of Assistant Professor Adelbert Philo Mills on October 20, 1918, the College of Civil Engineering sustained the loss of one of its most conscientious and industrious teachers.

Like many a man, in the stirring unsettled times through which we have just passed, he longed to be in the service of the United States, and during the summer of 1917 took an examination for a commission as Captain in the Engineer Corps. Passing this examination he had visions of early service, but it was not until May of 1918 that he was ordered to report to training camp. After a period of training at Camps Lee and Oglethorpe, he was assigned to overseas duty, reaching Brest, October 10, 1918. The military service in camp had been of a character most attractive to him, and he had entered into it with very marked enthusiasm. On the trip across the Atlantic he was one of the three or four officers able to be on duty, and his endeavors to attend to numerous necessary details for others, as well as for himself, were circumscribed only by his physical limitations. Weakened and tired by the heavy burden of duties, incident to departure and while on shipboard, he was unable to survive an attack of cerebro-spinal meningitis and thus at the very dawn of his career as an active participant in the great conflict he was called to lay down the working tools of life.

Born November 10, 1883, he began preparation for his life's work at the University of Michigan where in 1906 he received the degree of B.S., and where in 1909 he was awarded the degree of M.S. In September of the same year he came to the College of Civil Engineering, well recommended, and was placed in charge of the work in Materials of Construction. With others at that time he felt the need of a better text in his chosen subject than existed and for several years directed his energies not only to modifying and revising the courses which came under his supervision, but also to the preparation of manuscript for his now widely used text "Materials of Construction" which appeared first in mimeographed form and which after use in the class room he published in book form in 1915.

The concise, practical way in which he presented the subject matter and the thoroughness with which he covered the field gained for him speedy recognition, and he was made a member of important committees of the American Society of Testing Materials charged with various investigations of building materials, and was also invited to contribute the section on the "Properties of Cement Mortar and Concrete" in the recently published "Handbook of Concrete" by Hool and Johnson.

In addition to his work in the class-room he did much work of a commercial character, ranging from ordinary tests of cement, brick, concrete, etc., to an investigation of the maximum stresses encountered in the shell of a paper pulp digester during its operation.

His energy, his faithfulness to his duties, his resourcefulness, and his efforts to improve scholarship in the college have been the means of setting a standard to attain which his successor must labor with diligence and perseverance.

CHARLES B. HAGADORN, Class of 1886

DIED AT CAMP GRANT, ILL., OCTOBER 8, 1918

Colonel Charles Baldwin Hagadorn of Elmira, N. Y., committed suicide at Camp Grant, Ill., on October 8. It is believed that worry over the influenza epidemic in the camp was responsible for the act.

Col. Hagadorn entered the College of Civil Engineering in 1882, but went to West Point in 1884 where he received his commission in 1889. He was assigned to the Twenty-third Infantry. He served in the Spanish-American War, was military attache of the American legation at Petrograd, was chief of staff in the Canal Zone, and was for fourteen years an instructor in drawing at West Point. He became a Colonel in 1917.

At the time of his death Colonel Hagadorn was in command of the Central Officers' Training School at Camp Grant, and was in charge of a post numbering over forty thousand officers and men.

He was never married, and is survived only by a sister, Mrs. Charles A. Bowman, of Elmira.

CHARLES FERGUSON COOK, C.E., 1906

DIED AT NEW YORK, JANUARY 1, 1919

Major Charles Ferguson Cook, O. R. C., died of influenza at the St. Luke Hospital, New York City on January 1, 1919.

Cook was a son of Mr. and Mrs. W. N. Cook, of Utica, New York, and was born on August 16, 1883. He entered the College of Civil Engineering from Utica Free Academy in 1902, and received the degree of Civil Engineer in 1906. He was a member of Delta Upsilon, Quill and Dagger, Rod and Bob, and the Morse Stephens Debate Club. He was President of the Association of Civil Engineers in his senior year and was awarded the Fuertes Medal for having maintained the highest scholarship in his class.

After completing his course at Cornell he spent two years at Princeton as a graduate student. He was then employed by J. G. White & Co. in their hydraulic department until March 1910, when he went to Asia Minor as engineer in charge of excavations of the ancient city of Sardis for the expedition under the supervision of Professor H. C. Butler, of Princeton.

Returning to this country in July of the same year, he reentered the employ of J. G. White & Co. as Assistant Engineer on a hydro-electric installation at Bonny Eagle, Maine. He was then employed by the Power Construction Company at Shelburne Falls, Mass. as Assistant Hydraulic Engineer, Assistant to President, and Resident Engineer until 1914, when he spent some time on hydro-electric investigations in Cuba.



Soon after the outbreak of the European war Cook entered the employ of the British Munitions Board to take charge of the Pittsburgh District which handled over seventy-five per cent of their industrial activities in America, resulting virtually in the creation of a new American industry of shell making. Thus when America entered the war he was one of the few in this country fully acquainted with shell making in which work he had made a splendid record. He had just entered the employ of J. P. Morgan & Co. to assist F. R. Stettinus, later Assistant Secretary of War, in this work for the British, but early volunteered and received a commission as Major in the Ordinance Reserve Corps in July 1917.

His first work was the organization of the Purchase Section of the Gun Division which gave full play to exercise of his remarkable organizing ability. He brought together many able men of great experience in the British work and under his leadership this organization did the ground work upon which all later procurement functions of the Ordinance Department were based. When the Gun Division was merged into the Procurement Division Major Cook was assigned to the Purchase, Storage and Traffic Division where he organized, under General Goethals, the consolidation of all purchase functions of the Government. Major Cook did a man's size job and brought to the work a vision and an inexhaustible effort which was of great value in the trying days of the organization work of carrying on the war. His loss is keenly felt by the Department.

In a letter to the *Cornell Alumni News* Captain Antonio Lazo, '07, says: "I doubt very much, and I say this after much thought, if there was or is *any* individual in the service who has a greater record of constructive achievement in organizing us for war than Charlie had. He sacrificed his desire to go to France, having hoped that he would get over before the campaign of 1919, which was what we were preparing for. In commenting on his death you cannot be too emphatic on the immense services he rendered which are known only to the War Department and to those who were privileged enough to be working with him."

The military funeral took place in St. Cornelius' Chapel, Fort Jay, Governor's Island, on January 3.

#### ELMER STANLEY TERHUNE, C.E., 1909

KILLED IN ACTION, NOVEMBER 8, 1918

Lieutenant Elmer Stanley Terhune, Field Artillery, U. S. A., was killed in action on November 8.

Terhune was a son of Mr. and Mrs. Frank A. Terhune of Newark, N. J. He was born at West Milford, N. J. on July 6, 1886, and after graduating from the Newark High School entered the College of Civil Engineering in 1905, receiving his degree in 1909.

Terhune's engineering experience began with the Turner Construction Company of New York as draftsman on plans for reinforced concrete buildings. From September to November 1909 he had charge of the installation of the Waring system of sewage disposal in country homes and institutions for Waring, Chapman & Farquhar, of New York City.

He then spent two and a half years as draftsman and inspector for the Batavia (N. Y.) Sewer Commission, having charge of drafting, special designs, making permanent record maps, etc. In the spring of 1912 he entered the employ of the Municipal Board at Newark, N. Y., as Assistant Engineer, and in March 1913 was made Resident Engineer. In this position he had charge of the entire sewer system and disposal plant of Newark.

In 1914 he became associated with Phillip Z. Horton, '10, under the firm name of Terhune & Horton, Civil and Sanitary Engineers of Peoria, Ill. This partnership continued until he entered the service. He received his training at Fort Sheridan, Illinois, and was commissioned a second lieutenant in the Field Artillery.

#### HUNTER McCLURE, C.E., 1910

DIED IN FRANCE, SEPTEMBER 26, 1918

Lieutenant Hunter McClure, of the 21st U. S. Engineers, died of disease in France on September 26.

McClure was born in Rome, Ga. on December 23, 1887 and came to Cornell after having taken the degree of B.S. in C.E. in 1908 at the Georgia School of Technology. Having spent several summers on engineering work and having many advanced credits, he spent only a year at Cornell and the degree of C.E. was granted him in 1910. From September 1909 to September 1910 he was employed on railroad work, but left it to spend a year as instructor in mechanics in Sibley College. From June 1911 to March 1912 he served as draftsman for the American Bridge Company at various plants and in the New York office and then spent a year on railroad work mostly on the construction of the Payette River Bridge for the Idaho Northern Railway.

He reentered the employ of the American Bridge Company in March 1913, but left in July to take a position as draftsman in the Bridge Department of the Chesapeake & Ohio Railway where he designed many new structures and investigated the strength of existing ones. In November 1914, he entered the Division of Valuation of the Interstate Commerce Commission and was in charge of a field party at the time of his enlistment in December 1917. He was commissioned a First Lieutenant of Engineers and trained at Camp Lee, Va.

McClure was an Associate Member of the American Society of Civil Engineers.

#### EDGAR MONTGOMERY WHITLOCK, C.E., 1910

KILLED IN ACTION IN FRANCE, SEPTEMBER 26, 1918

First Lieutenant Edgar Montgomery Whitlock, 102d U. S. Engineers, was killed in action on September 26.

Whitlock was born on November 26, 1888, and was the son of Mr. and Mrs. Edgar Whitlock, of Brooklyn, N. Y. He entered Cornell in 1906 from the Boys' High School, Brooklyn, and received the degree of Civil Engineer in 1910. He was a member of Theta Xi, and of Pyramid. He rowed on the freshman C.E., and Junior varsity crew.

During his first two years in college, he was a member of the Banjo Club, becoming leader in his sophomore year, and in his junior and senior years was a member of the Mandolin Club.

After his graduation he was employed for a time as civil engineer with the Portland Railway, Light and Power Company, Estacada, Oregon, and was engaged in hydraulic construction on the Clackamas River. Later he became associated with the Eastwood Construction Company, engineers and builders of San Francisco.

He attended the first series of officers' training camps, and was commissioned a first lieutenant in the Engineer Reserve Corps. He went to France in June, 1917, with Company B, 18th Engineers. At the time of his death he was with the 102d Engineers.

#### HOWARD RAYMOND MOORE, C.E., 1913

DIED AT CAMP HUMPHREYS, VA., OCTOBER 6, 1918

Candidate Howard Raymond Moore, U. S. Engineers, died of pneumonia at Camp Humphreys on October 6.

Moore was born at Middletown, New York in 1891. He prepared for college at Patchogue and Ithaca High Schools, entered Cornell University in 1909 and graduated from the College of Civil Engineering with the degree of Civil Engineer in 1913.

After graduation he worked for one year on subway construction in New York City, and for the following two years on ore dock work at Coquinto, Chile, South America. The next year he was assistant superintendent on power-house construction at Omaha, Nebraska, from which position he resigned in 1917 to enter the service of the Government.

He served with the U. S. Army Signal Corps on the construction of Aviation Fields at Fort Worth, Texas and later at Lonoke, Arkansas. His last service was as a member of Company No. 3, Engineer Officers' Training School at Camp Humphreys, Va., where shortly before the completion of the course he contracted pneumonia and died October 6th, 1918.

He is survived by his father, I. T. Moore of Patchogue, L. I., his sisters, Fannie M. Moore and Mrs. H. C. Woodward, and by a brother, Egbert J. Moore, C.E., '99.

He will be remembered for his friendly, genial and enthusiastic nature by all who knew him, his classmates, his business associates and those alongside of whom he served his country.

#### DAVID OETTINGER, C.E., 1914

DIED AT CAMP MEADE, MD., OCTOBER 7, 1918

Lieut. David Oettinger, Q. M. C., died at Camp Meade, Md., on October 7. The cause of his death was pneumonia, following an attack of influenza.

Oettinger was twenty-six years old. He prepared for college at the Central High School, Washington, D. C., and entered Cornell in 1910, receiving the degree of Civil Engineer in 1914. He was a lieutenant.

ant in the Cadet Corps during his sophomore and junior years, and became a captain in his senior year. Later in the same year he was made a major. He was a member of Zeta Beta Tau.

He entered the service as a private last fall, and in June was commissioned a lieutenant in the Quartermaster Corps, utilities branch, and assigned to Camp Meade.

Lieutenant Oettinger is survived by his mother, Mrs. Bertha R. Oettinger, of Washington, and a sister, Mrs. Allen V. De Ford.

### RALPH RICHARDSON MARRIAN, C.E., 1915

DIED OF WOUNDS IN FRANCE, OCTOBER 17, 1918

First Lieutenant Ralph Richardson Marrian died at Bohain, France, on October 17, from wounds received while leading his platoon through the town of Molain.

Marrian was born on March 24, 1890, and entered the College of Civil Engineering from Valparaiso University in 1910, receiving the degree of Civil Engineer in 1915. He was a member of Scroll and Spade.

For some time after his graduation, Marrian was employed in the electric division of the New York Central Railroad Company, in New York. He served on the Mexican border with Company L, 7th New York Infantry, and in the fall of 1917 entered the Engineer Training Camp at Camp American University, Washington, D. C. He was commissioned a Second Lieutenant in the Engineer Reserve Corps, and was transferred to Camp Sevier, Greenville, S. C., where he was attached to Company B, 105th Engineers. He went to France with this regiment last September, and had recently been promoted to First Lieutenant.

He was buried in the military cemetery at Montbeliard, France, and his men have erected a neat white fence around his grave, and placed a large white cross at its head. Marrian was a Junior member of the American Society of Civil Engineers.

### CHARLES CURTIS BEAKES, C.E., 1916

DIED IN FRANCE, OCTOBER 9, 1918

Charles Curtis Beakes died of pneumonia in France on October 9.

Beakes was born on March 21, 1894 and received his early education in Sidney Center, New York. After graduating from the Sidney Center High School he attended Columbia University, and entered the College of Civil Engineering at Cornell in 1912, receiving his degree in 1916.

Before entering the service he was employed by the Genesee Bridge Company, Rochester, New York. He was a member of the Rochester Engineering Society.

He enlisted on April 15, 1918 at Rochester, N. Y., and spent a short period of training at the 34th Recruit Squadron Aviation Camp at Waco, Tex. He was later assigned to the Meteorological Department of the Signal Corps and sent to College Station, Texas. He sailed for



France on September 21, a member of Company 32, Meteorological Detachment, Signal Corps.

Beakes was married on August 27, to Miss Emily Lewis '18, who survives him. He leaves also his father, Charles H. Beakes of New York and a sister, Mrs. C. B. Dibble, of Sidney Center, New York.

### JAMES HENDERSON SPAFFORD, C.E., 1917

KILLED IN ACTION, OCTOBER 9, 1918

First Lieutenant James Henderson Spafford was killed in action on October 9. While leading his men against a machine gun nest he was wounded in the arm, but remained with his command. A few minutes later a bullet went through his stomach, and he fell mortally wounded. He was taken to a first aid and dressing station and then to a base hospital, but was unconscious when he arrived, and died about two hours later.

Spafford was born on October 9, 1892 and entered Cornell from the Baltimore Polytechnic Institute. He was registered in the College of Civil Engineering in 1915 and received his degree in 1917. He was a member of Phi Gamma Delta, Pyramid and the Maryland Club.

He attended the First Officers' Training Camp at Fort Myer, Va., and was commissioned a second lieutenant of engineers. He sailed for France in September 1917, and after spending about eight months in more specialized training at Versailles, was sent to the front, receiving his promotion to first lieutenant soon after. The Second Engineers of which he was a member, were with the Marines in the famous Chateau Thierry drive. Lieutenant Spafford was recommended for a captaincy shortly before his death, and was decorated with the Distinguished Service Cross.

Spafford had several narrow escapes during his numerous trips into No Man's Land. Once, while rendering aid to one of his men who had been shot in the neck, he was knocked unconscious by the concussion of a shell. Another time, he and a corporal were going through some enemy trenches to see what they could find and had discovered many valuable papers and sketches, and were about to return when they were discovered. The enemy opened machine gun fire on them but they escaped, his only injury being a skinned nose.

Lieutenant Spafford leaves his parents, Mr. and Mrs. James A. Spafford of Baltimore, Md., and a sister, Mrs. Edgar G. Carlyle of Philadelphia, Pa.

### HOWARD JACKSON BUSH C.E. Class of 1920

DIED IN SERVICE AT NEWPORT, R. I., SEPTEMBER 5, 1918

Howard Jackson Bush died of pneumonia on September 5, at the Naval Hospital, Newport, R. I.

Bush prepared for college at the Gloversville High School and entered the College of Civil Engineering in October 1916. He was a member of Phi Kappa Psi.

He enlisted in the Naval Reserves on May 7, 1917, but was permitted to return to the University, and succeeded in completing his second year. He was called into service on July 30, and ordered to the Naval Torpedo Station at Newport. He was stricken with pneumonia on September 9, and when his condition became critical his father was summoned.

He is survived by his parents, Mr. and Mrs. Frank J. Bush, and a sister, Miss Winifred Bush of Gloversville, New York. He was twenty-one years old.

JOHN FRANCIS TIERNEY, JR., Class of 1921

DIED AT ITHACA, NEW YORK, OCTOBER 26, 1918

John Francis Tierney, Jr., died at Cascadilla Hall on October 26, of pneumonia, following influenza.

Tierney was born on August 7, 1900, and was the son of Mr. and Mrs. J. F. Tierney, of Middletown, New Jersey. He prepared for college at the Brooklyn Polytechnic Institute and entered the College of Civil Engineering in 1917. He was a member of Section A of the S. A. T. C.



## THE ROLL OF HONOR

Cornell, with the true spirit of an American University, has played a great part in the fight for democracy both before and during the war.

Her sons were found on almost every battlefield and everywhere they have done their part as worthy Cornellians. In the forces of both the Army and the Navy, men from the College of Civil Engineering were found in great numbers, many of them in high places. These men played their part well, and not a few, willingly paid the great price. Not only did Cornell men do their share on the battlefields, but also in the quieter walks of life by helping the men over there and over here. Although they do not receive the glamour and glory that goes with the military service, the work they have done will not let them be forgotten.

On these pages are published the obituaries of a number of C.E. graduates who have died either in service or in civilian life and our sympathy goes out to the members of their families. We are proud of their sacrifices and take this opportunity of honoring those who have honored us.

## THE ROLL OF HONOR

Assistant Professor ADELBERT PHILO MILLS, Captain U. S. Engineers.  
Died in service at Brest, France, October 20, 1918.

CHARLES B. HAGADORN, Class of 1886, Colonel U. S. Infantry. Died  
in service at Camp Grant, Ill., October 8, 1918.

CHARLES FERGUSON COOK, C.E., '06, Major U. S. O. R. C. Died in  
service at New York City, January 1, 1919.

ELMER STANLEY TERHUNE, C.E., '09, 2d Lieutenant Field Artillery,  
U. S. A. Killed in action, November 8, 1918.

HUNTER McCLURE, C.E., '10, 1st Lieutenant, U. S. Engineers. Died  
in service in France, September 26, 1918.

EDGAR MONTGOMERY WHITLOCK, C.E., '10, 1st Lieutenant U. S. En-  
gineers. Killed in action, September 26, 1918.

HOWARD RAYMOND MOORE, C.E., '13, U. S. Engineers. Died in service  
at Camp Humphreys, Va., October 6, 1918.

HAROLD ALEXANDER MOSSMAN, C.E., '14, Captain 3d Royal Berkshire  
Regiment. Awarded Military Cross for bravery and devotion  
to duty at Poelcappelle in October, 1917. Awarded Parchment  
certificate for gallantry and devotion to duty during the great  
German offensive of the Spring of 1918.  
Killed in action at Villers Bretonnex, France, April 25, 1918.

DAVID OETTINGER, C.E., '14, Lieutenant Q. M. C. Died in service at  
Camp Meade, Md., October 7, 1918.

RALPH RICHARDSON MARRIAN, C.E., '15, 1st Lieutenant U. S. Engineers.  
Died of wounds at Bohain, France, October 17, 1918.

CHARLES CURTIS BEAKES, C.E., '16, Meteorological Detachment, Signal  
Corps, U. S. A. Died in service in France, October 9, 1918.

JAMES HENDERSON SFAFFORD, C.E., '17, 1st Lieutenant U. S. Engineers.  
Awarded Distinguished Service Cross for extraordinary heroism in  
action. Wounds received in the attack caused his death October 9,  
1918.

JOHN EDWARD LUDFORD, Class of 1918, Cadet Royal Flying Corps.  
Killed in aeroplane accident at Camp Borden, Canada, September  
18, 1917.

HOWARD JACKSON BUSH, Class of 1920, U. S. Naval Reserve Corps.  
Died in service at Newport, R. I., September 5, 1918.

JOHN FRANCIS TIERNEY, JR., Class of 1921, Cornell Unit, S. A. T. C.  
Died in service at Ithaca, New York, October 26, 1918.



Kenneth Bertrand Turner *By courtesy of White Studio*



## IN MEMORIAM

KENNETH BERTRAND TURNER, C.E. '83, M.C.E. '85

DIED AT SCRIBA, N. Y., OCTOBER 21, 1918

Assistant Professor Kenneth B. Turner died at Scriba, N. Y., October 21, 1918, of pneumonia following an attack of Spanish influenza.

Professor Turner was the son of Mr. and Mrs. Bertrand Turner and was born at Scriba, N. Y. on July 19, 1882. After a course in the Oswego High School he entered Cornell in 1899, receiving his degree of C.E. in 1903 and the degree of M.C.E. in 1905. He was a member of Sigma Xi.

In 1903 he became connected with the hydrographic division of the U. S. Geological Survey, and was for some time employed on the lake surveys. He became an instructor in civil engineering in the University in 1906, and in 1908 was promoted to the position of assistant professor of hydraulics, which he filled with great credit and efficiency.

He leaves his wife, two daughters, Ruth and Jane, and a son Kenneth B., Jr.

Professor Turner had a host of friends drawn to him by the generosity with which he gave his interest to their view points, by his genial good nature, by his sterling uprightness, by his sense of humor and by his fine physique coupled with moral fiber of superior quality.

As a teacher he inspired good work by his own example in thorough preparation for each day's schedule; by the care he took in drawing out the capacities of the students, urging the brilliant to additional studies and patiently guiding the slow; by the mental discipline he developed and stimulated continuously through exaction of precision and promptness; by his unfailing sympathetic interest in students' difficulties.

In experimental investigation the writer was associated with him for the last eight years. We pulled well together and jointly overcame many an obstacle. Now my close friend and long time co-worker is gone. The keen sense of personal loss of friendship and comradeship in the alluring arduous path of science is coupled with a realization of the loss to the world of a trained, skillful and reliable investigator in his early prime.

It is indeed regrettable that he is not able to give his much needed assistance to the completion and publication of our studies on the flow of water over weirs nor to enjoy the contemplation of a well chosen task done. Fortunately several phases of the work are well advanced and the interpretation of results has had the benefit of his counsel.

He desired most intensely to give his services to the army. By a queer turn of fortune, defective eyesight was held against one of the best expert riflemen at the 1916 Plattsburg camp. Failing in his wish he rendered valuable services in the Students' Army Training Corps at Cornell and also carried out experimental investigations in hydraulics for the government.

He achieved to an unusual degree the task: "To be honest, to be kind, to earn a little, to spend a little less; upon the whole to make a family happier for his presence; to renounce when that shall be neces-

sary and not to be embittered; to keep friends but these without capitulation; above all upon these same given conditions to keep friends with himself;—here is a task for all that a man has of fortitude and of delicacy.”

He himself might have said:

“Under the wide and starry sky  
Dig me a grave and let me lie.  
Glad did I live and gladly die,  
And I laid me down with a will,  
Home is the sailor, home from sea,  
And the hunter home from the hill.”

E. W. S.

### SAMUEL TURNEY NEELY, C.E., 1895

DIED AT CAPE GIRARDEAU, MO., AUGUST 6, 1918

Samuel Turney Neely died of meningitis on August 6 at Cape Girardeau, Mo.

Neely was graduated from the College of Civil Engineering in 1895, and after his graduation held the following positions: 1895-1896, expert assistant engineer in the Office of Public Roads, Washington, D. C.; 1897, engineer expert in the Forestry Division, Washington, D. C.; 1898, assistant engineer on the Hannibal and St. Joseph Railway, St. Joseph, Mo.; 1899, engineer at Paris, Ky.; 1900-02, resident engineer, in charge of construction for the C. B. and Q. Railroad, Macon, Mo.; 1903, civil engineer with the Forestry Bureau, Manila, P. I.; 1904-05, engineer in charge of construction on the Canton-Hankow Railway, Canton, China; 1906, superintendent of construction with the Fitzgerald Construction Company, Mt. Carmel, Ill.; 1907, superintendent of construction with the A. and M. Electric Railway, Jonesboro, Ga.; 1908-10, general superintendent of Lane Brothers, railroad contractors at Estmont, Va.; Church Hill, Tenn., and Altavista, Va.; 1911, engineer at Kansas City, Mo.; 1912-13, general manager of the Carter Construction Company at Cumberland, Md., and Disko, Ind.; 1914-15, with the Douglass Head Construction Company, Disko, Ind.; 1916-18, general manager of the Floresch Construction Company, Cape Girardeau, Mo.

He is survived by his widow, who lives at 5227 Cornell Avenue, Chicago.

### OGDEN MERRILL, C.E., 1899

DIED AT BROOKLYN, NEW YORK, OCTOBER 5, 1918

Ogden Merrill, President of the Merrill-Ruckgaber Co., Contracting Engineers, died of pneumonia on October 5, at the age of forty years.

He was the son of Mr. and Mrs. E. W. Merrill, of Brooklyn, and was graduated from the College of Civil Engineering in 1899. He was a member of Rod and Bob, played on the '98 basketball team, and was captain of the '99 team.

Merrill had had a large engineering experience. He began work with Ira A. Shaller, on the Park Avenue Tunnel of the New York Subway.

Later, while connected with the United Engineering and Contracting Company, he was engineer and superintendent of the electric pumping station at the Brooklyn Navy Yard and built the bridge over Croton Lake for the Putnam Division of the Central. As engineer and superintendent he helped in the construction of the Pennsylvania Railroad tunnels under the North River. Still later, as superintendent for the New York Tunnel Company, he was in charge of the construction of the tunnel from the Battery to Brooklyn. For the past ten years he had been President of the Merrill-Ruckgaber Company, contracting engineers, of New York. Among the projects on which the company was engaged were concrete bridges for the Lackawanna, the Long Island, and the Jersey Central, sewers in New York and Toronto, the water system for Cumberland, Md., and bridge foundations at Chattanooga, Tenn., Lawrence, Mass., and Mamnasquan, New Jersey. Merrill himself was the inventor and patentee of a method of sinking pneumatic caissons by a telescopic process.

He married Miss Laura Ruckgaber, of Brooklyn, on October 26, 1905. Merrill was an Associate Member of the American Society of Civil Engineers and a member of the Brooklyn Engineers' Club.

JULIUS LILIEN JACOBS, C.E., 1904

DIED AT NORFOLK, VA., OCTOBER 2, 1918

Julius Lilien Jacobs, '04, died of pneumonia on October 2, at Norfolk, Va.

Mr. Jacobs was born on April 6, 1882, at Atlanta, Texas and was the son of Mr. and Mrs. Morris Jacobs. He was a good student and at the age of seventeen received the degree of B.Sc. from the University of Texas. He entered Cornell in 1900, graduating in 1904, with the degree of C.E. In his junior year as a recognition of his scholarship he was appointed computer of the junior survey, and as a senior was editor-in-chief of the "Transactions of the Association of Civil Engineers." In his senior year his worth was again recognized by his election to the honorary society of Sigma Xi.

For three years following his graduation he was employed by the Chicago and Northwestern Railroad, first as instrument man on the construction of the Pierre-Rapid City extension, and later as a field engineer. February, 1907, he entered the employ of the James Stewart and Company, contractors, of St. Louis, as engineer in charge of railroad construction for the Missouri, Kansas and Texas Railway Company at Parsons, Kansas. Following this he was made superintendent of construction for the Missouri, Kansas and Texas Railway Company Freight Terminal at Fort Worth, Texas. In 1911 he became manager of the Houston and New Orleans office of James Stewart and Company, and at the time of his death was in charge of contracts of that company in the Hampton Roads district aggregating twelve million dollars.

Jacobs was a member of the American Society of Civil Engineers.

From the time he entered the university he took an active interest in the activities of the college, and made himself one of the marked men in his class. On entering his life's career he exhibited the same energy

and enthusiasm that he had shown through his college course and as a result "he ran true to form." The future was bright before him and in his death the class of 1904 in C.E. loses one of its most promising members, the college of Civil Engineering one of its wide-awake and vigorous minds, and the University an alumnus who, had years been spared him, would have added lustre to the achievements of its civil engineers.

JULIUS FREDERICK BRAUNER, JR., C.E., 1905

DIED AT ITHACA, N. Y., SEPTEMBER 4, 1918

Julius Frederick Brauner, Jr., died on September 4 at his home, 409 South Albany Street, Ithaca, at the age of thirty-eight. Mr. Brauner attended the Ithaca High School, and the Boston Latin School, entering Cornell in 1901, and receiving his C.E. degree in 1905. In his university course he won a University Scholarship and took part in other student activities. His work as a student and during his professional career was characterized by a lively interest in the problems of social progress and a deep-seated pride in his chosen profession of Civil Engineering.

Upon his graduation, he entered the employ of Ford, Bacon and Davis, of New York, and in 1910 returned to Cornell as an instructor in the College of Civil Engineering. This position he held until 1916, when he resumed his former position in New York. He was a member of the American Electric Railway Association.

Mr. Brauner leaves his widow, two daughters, a son, and two brothers, Professor Olaf M. Brauner of Ithaca and Henry A. Brauner, '09, of Staten Island. The funeral at which Dr. William Elliot Griffis officiated was held from the home on September 6, 1918.

DONALD POWER DENHAM, C.E., 1914

DIED AT PETERBORO, ONTARIO, OCTOBER 23, 1918

Denham was born at Akron, Ohio, on June 14, 1890, the son of Mr. and Mrs. W. H. Denham. In 1904 the family moved to Peterboro, where Denham received his early education. He prepared for college at the Peterboro Collegiate Institute, and entered the College of Civil Engineering in 1910, receiving his degree in 1914. He was a member of Sigma Nu, Semaphore, and the Glee Club, and was a member of the CIVIL ENGINEER board.

After graduation, he became city sales manager in the automobile department of the Peterboro Machine and Lubricator Company. He held this position for about a year and then entered the service of the Leonard Construction Company of Chicago, as field engineer, and was in charge of the construction of manufacturing plants in Cedar Rapids, Iowa, Franklin, N. J., Kansas City, Kans., and Saskatoon, Sask. He also superintended the construction of the immense buildings of the Quaker Oats Company in Peterboro. While working in Saskatoon, he received a Government appointment with the Bureau of Yards and

Docks in Charleston, W. V., and was on his way to that place when he was taken ill.

He had made several efforts to get into the service, but owing to a number of severe illnesses in previous years, was unable to pass the physical examination.

He is survived by his parents, Mr. and Mrs. W. H. Denham of Peterboro.

CHARLES SPIELMAN, C.E., '15

DIED AT PHILADELPHIA, PA., ON OCTOBER 11, 1918

Charles Spielman died in the Presbyterian Hospital, Philadelphia, on October 11, from pleuro-pneumonia, resulting from Spanish influenza.

He was a son of Mrs. Bertha Spielman, of Brooklyn. He entered Cornell from Columbia University in 1911, and received the degree of Civil Engineer in 1915. He was a member of Phi Beta Delta.

Spielman was at one time connected with the New York Public Service Commission, but was more recently employed in the hull construction department of the American International Shipbuilding Corporation, stationed at Camden, N. J.

Besides his mother, he leaves three brothers, David Bernat, '20, Benjamin, and Ignatius.





*Courtesy of J. P. Troy*

Class of 1922

# KEY TO THE 1922 CLASS PHOTOGRAPH

## NUMERICAL LIST

- |                          |                       |
|--------------------------|-----------------------|
| 1. Adamson, W. M.        | 35. Roberts, H. A.    |
| 2. Wurts, J. J.          | 36. Hyer, C. R.       |
| 3. Bryant, C. E., Jr.    | 37. Anderson, R. S.   |
| 4. Haskell, E. E.        | 38. Kohler, A. H.     |
| 5. Shanklin, G. R.       | 39. Brayman, G. I.    |
| 6. Smith, J. W.          | 40. Cruz, C. A.       |
| 7. Taussig, F. B.        | 41. Evans, W. H.      |
| 8. Becker, Robt.         | 42. Griffin, H. W.    |
| 9. Loomis, A. P.         | 43. Scudder, R. C.    |
| 10. Houck, N. L.         | 44. Scott, O. W.      |
| 11. Klein, D. N.         | 45. Maahs, A. J.      |
| 12. Sanchez, C. A.       | 46. Calloway, R. W.   |
| 13. Pascual, V. P.       | 47. Liu, C. S.        |
| 14. Carpenter, C. W.     | 48. Amreich, L. S.    |
| 15. Morris, A. M.        | 49. Smitn, J. H.      |
| 16. Neum, J. H.          | 50. Lake, F. W.       |
| 17. Fudge, R. G.         | 51. Crooks, W. J.     |
| 18. Benson, H. J.        | 52. Garrabrant, R. B. |
| 19. Williams, P. T.      | 53. Feinson, S. H.    |
| 20. Thompson, Robt.      | 54. Garry, J. W.      |
| 21. O'Britis, Edw. W.    | 55. McKee, E. P.      |
| 22. Volpe, I. J.         | 56. Corney, B. S.     |
| 23. Underwood, W. L.     | 57. Underwood, B. O.  |
| 24. Copeland, D. L.      | 58. Brown, F. J.      |
| 25. Conkling, F. E., Jr. | 59. Garfinkel, Harry  |
| 26. Barreto, B. F.       | 60. Davey, T. T., Jr. |
| 27. Martinez, A.         | 61. Roberts, A. Y.    |
| 28. Madrinan, R.         | 62. Mutchler, J. P.   |
| 29. Gericke, H.          | 63. Van Pelt, W. H.   |
| 30. Karnow, A.           | 64. Leitch, P. W.     |
| 31. Kupfer, M.           | 65. Cooly, Geo. R.    |
| 32. Havelin, J.          | 66. Williams, D. D.   |
| 33. Lopinsky, L.         | 67. Dean, C. E.       |
| 34. Huyck, R. S.         | 68. Bernard, W. S.    |

## ALPHABETICAL LIST

- |                          |                      |
|--------------------------|----------------------|
| 1. Adamson, W. M.        | 11. Klein, D. N.     |
| 48. Americh, L. S.       | 38. Kohler, A. H.    |
| 37. Anderson, R. S.      | 31. Kupfer, M.       |
| 26. Barreto, B. F.       | 50. Lake, F. W.      |
| 8. Becker, R.            | 64. Leitch, P. W.    |
| 18. Benson, H. J.        | 47. Liu, C. S.       |
| 68. Bernard, W. S.       | 9. Loomis, A. P.     |
| 39. Brayman, G. I.       | 33. Lopinsky, L.     |
| 58. Brown, F. J.         | 45. Maahs, A. J.     |
| 3. Bryant, C. E., Jr.    | 28. Madrinan, R.     |
| 46. Calloway, R. W.      | 27. Martinez, A.     |
| 14. Carpenter, C. W.     | 55. McKee, E. P.     |
| 25. Conkling, F. E., Jr. | 15. Morris, A. M.    |
| 65. Cooly, G. R.         | 62. Mutchler, J. P.  |
| 24. Copeland, D. L.      | 16. Neum, J. H.      |
| 56. Corney, B. S.        | 21. O'Britis, E. W.  |
| 51. Crooks, W. J.        | 13. Pascual, V. P.   |
| 40. Cruz, C. A.          | 61. Roberts, A. Y.   |
| 60. Davey, T. T., Jr.    | 35. Roberts, H. A.   |
| 67. Dean, C. E.          | 12. Sanchez, C. A.   |
| 41. Evans, W. H.         | 44. Scott, O. W.     |
| 53. Feinson, S. H.       | 43. Scudder, R. C.   |
| 17. Fudge, R. G.         | 5. Shanklin, G. R.   |
| 59. Garfinkel, H.        | 49. Smith, J. H.     |
| 52. Garrabrant, R. B.    | 6. Smith, J. W.      |
| 54. Garry, J. W.         | 7. Taussig, F. B.    |
| 29. Gericke, H.          | 20. Thompson, R.     |
| 42. Griffin, H. W.       | 57. Underwood, B. O. |
| 4. Haskell, E. E.        | 23. Underwood, W. L. |
| 32. Havelin, J.          | 63. Van Pelt, W. H.  |
| 10. Houck, N. L.         | 22. Volpe, I. J.     |
| 34. Huyck, R. S.         | 66. Williams, D. D.  |
| 36. Hyer, C. R.          | 19. Williams, P. T.  |
| 30. Karnow, A.           | 2. Wurts, J. J.      |

# THE CORNELL CIVIL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR BY

The Association of Civil Engineers of Cornell University  
Ithaca, N. Y.

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## EDITORIALS

### Board Elections

The Board takes pleasure in announcing the election of A. O. Degling Jr., '20, of East Orange, N. J. and Bernard J. Harrison '20, of Brooklyn, N. Y. to the Junior Business Board.

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### Resumption of Publication

With the return to normal conditions, and the rehabilitation of the class room, subsequent to the demobilization of the S. A. T. C., comes the reorganization and the setting in motion of college activities.

Absence of board members in military service and the unsettled conditions, necessitated the suspension of publication of the CIVIL ENGINEER from October, 1918 to January, 1919. With the ranks of the staff again brought to practically full peace strength, by the return of its members, publication is resumed with this issue.



**Semi-  
Logarithmic  
Paper**

As the laws met in engineering are not always so obliging as to plot in straight lines on ordinary cross-section paper, and thus make the determination of their equations simple, the engineer should be thoroughly familiar with every means of straightening out the curve of a law. Logarithmic paper will do this for equations of one asymptote, such as those commonly met in hydraulics. Going a step further Mr. E. W. Lane, '14, shows on page 3 the application of semi-logarithmic paper for determining equations of curves of one asymptote; curves that cannot be solved by the use of ordinary logarithmic paper.

**Registration  
Bureau  
Cornell  
Society of  
Civil  
Engineers**

The Cornell Society of Civil Engineers maintains a Registration Bureau with the twofold purpose of aiding Cornell men returning to civil life from military service, in finding employment; and the shifting of those who are uncongenially or unprofitably employed. The Bureau makes no charges and is run without profit. Complete up-to-date and impartial records of 2,000 men on file are available to employers; and in the interest of the employers no man will be recommended unless qualified.

The scientific methods of compiling, and indexing the qualifications of the men registered are outlined by Chairman C. S. Rindfoos, '06, on page 9 of this issue.

**The Consoli-  
dation of  
M.E. and C.E.**

The part that the United States will play in the economic affairs of the world will no doubt cause a development of its industry that will demand increased activity and many changes in its organization. Just what these changes will be, and what effect the reorganization of industrial methods will have on the practice of all branches of engineering, is a thing that can only be conjectured. By granting that there will be changes in the practice of engineering, it would naturally follow that the engineering education will need modification to re-adapt itself to the industrial conditions.

On November 10, 1917, the Trustees of the University appointed a committee of five of its members to investigate the expected changes in engineering practice and the modification of curriculum, necessary to meet the conditions. To this committee was added the conference committees of the Engineering Colleges, consisting of Acting Dean Kimball and Professors Diederichs and Gray of Sibley, and Dean Haskell and Professors Jacoby and Ogden of the College of Civil Engineering.

On February 26, 1918, the Faculty members of the committee made

a report at the request of the Trustee members recommending the merging of all engineering into one College of Engineering under one administrative head.

The supporters of the plan consider that the division of engineering into two colleges at Cornell, is a flaw in the organization caused by the historical fact that at the time of the establishment, Sibley College was a School of Mechanic Arts, which differed widely from mechanical engineering of a later date. In the fifty years following its establishment, the School of Mechanic Arts developed into the Mechanical Engineering School of today. Opponents of the consolidation refuse to consider the division a flaw and point out the individual success and fame of Sibley College and Lincoln Hall, that has placed them among the leaders of engineering institutions, many of which are organized into single engineering schools.

Although the fundamental principles of all engineering are the same, there is a divergence in the application of these principles in the various branches of engineering. The point at which the application of the principles diverge marks the stage in engineering education where it is impractical to use the same curriculum for all engineers. At one time M.E. Students attended classes in Lincoln Hall in Hydraulics, Mechanics and Descriptive Geometry but it was later decided that these fundamental subjects should be given in Sibley College in a different form than given at Lincoln Hall. Have conditions again changed so that it is practical to resume the merging of civil and mechanical engineering courses such as these, that there will result an economy in equipment and instructing?

The opinion of the C. E. students in general seems to be that the *esprit de corps* of Lincoln Hall will be "swallowed up" by the larger college.

The first information given out to the alumni since the inauguration of the committees for investigation in November 1917, was embodied in a joint letter to the alumni of the two colleges, dated October 1, 1918, outlining in brief the steps that have already been taken and pointing out the economy and efficiency of administration that might result from the merging. No formal expression of opinion has as yet come from the alumni.

It appears for the success of the plan and for the preservation of good will between all concerned,—which will in fact determine its success—that full information of the proceedings and findings of the committees be given publicity and that before any definite steps are taken, the Faculty, Alumni, and Students be given every opportunity to express an opinion, and in the final decision, their opinions be used with their respective weights.



## COLLEGE NOTES

### **The S. A. T. C. at Cornell University**

Cornell University, in compliance with the Government's request last fall, amplified its military instruction by establishing a unit of the Student Army Training Corps of the United States Army. This corps was created by the War Department to enable the universities and colleges to help in the training of America's new armies.

About 1200 men were inducted into the Army unit of the S. A. T. C. at Cornell and 350 into the Navy unit. The men were quartered in fraternity houses, forty of which were used as barracks, and "messed" at the Home Economics and Cascadilla cafeterias. Upon orders from the War Department's Committee on Education, demobilization of the S. A. T. C. was started the week of December 1 and was completed by December 21.

In an article, "Engineering Educators' Opinions Reflect Past and Predict Future Conditions", which appeared in the *Engineering News-Record* of January 16, under the heading, "Cornell Believes in Military Training in Spite of the S. A. T. C.", Dean Haskell writes:

"The experience with the S. A. T. C. at Cornell was rendered unsatisfactory by the actions of the younger officers, and the fact that orders to the military instructors and to academic authorities were not in duplicate resulting in confusion and conflicts in student hours. The general feeling in regard to the work of the corps was expressed when the faculty voted unanimously to refuse the opportunity for continuing the training to the end of the present year.

The Navy unit was administered successfully, but the Army Unit accomplished relatively little academic work. Study facilities

were inadequate, and officers monopolized the time in the evenings which should have been devoted to preparation for class work."

The opinion of the faculty and the student body is very accurately reflected in the Dean's letter to the *News-Record*.

### **Tau Beta Pi Elections**

Two juniors in the College of Civil Engineering, H. J. Benisch and L. G. Clay were elected to membership in Tau Beta Pi, the honorary scholarship society in Engineering, at the spring elections.

### **C.E. Honorary Societies**

The honorary societies of the College of Civil Engineering, Rod and Bob and Pyramid, held their elections recently. The undergraduates belonging to these societies are as follows:

#### ROD AND BOB

C. B. Bennett, J. H. Christian, L. G. Clay, A. O. Degling, H. S. Fisher, J. C. Gebhard, M. E. Gillette, C. J. Hasbrouck, G. S. Hiscock, L. W. Joseph, J. H. Lynch, Y. C. Ma, G. MacKellar, J. W. Martin, J. B. McClatchy, B. C. Michelson, J. Needle, J. O'Leary, O. J. Sewell, C. Stott, A. F. Stolz, R. H. Weir, L. R. Wells, P. S. Wilson, B. J. Woodbury, C. C. Woodruff, C. A. Wright. In service: R. B. Bowles, D. L., Dargue, T. D. Finn, H. H. Linnell, E. W. Neu, A. V. D. Wallace.

#### PYRAMID

H. J. Benisch, G. P. Bullard, T. L. Collum, G. E. Conover, F. S. Constans, J. W. Crane, A. S. Eisenbrandt, W. H. Emerson, W. A. H. Grantz, F. A. Haley, G. D. Hayes, M. W. Herriman, H. L. Hettinger, E. J. Lenahan, P. Lucchetti, D. G. Nethercot, C. M. Pendleton, Robert Schempf, J. E. Smith, R. C. West, G. C. Williams. In service: C. P. Coggins, D. G. Douglas, E. L. Duffies, P. E. Fitzpatrick, J. P. MacBean, D. M. Robinson, H. J. Senecal, S. A. Theard, W. C. White, A. W. Winship.

**Distinguished Service Cross** The Distinguished Service Cross was awarded First Lieutenant Gardner Phillip Allen, '16, of Flint, Mich. for G. P. Allen, for extraordinary heroism in action at Thiaucourt, '16 France, on October 9, 1918.

With the demobilization of the S. A. T. C. and the resumption of academic work on a normal basis the **The R. O. T. C.** R. O. T. C. is coming back to the same high plane which it held before the war. Cornell was handicapped before by a small Armory but now the government has turned over to the University the New State Drill Hall and for the first time the R. O. T. C. is able to drill there.

Although, as in previous years, the Infantry is the backbone of the Corps, an Artillery unit has been formed here and has awakened considerable interest among the students. Lt. Col. Christian is in charge of this branch of instruction and his plans include training in the light field guns of the famous French 75's variety. It is planned to get several of these guns and some trained artillery horses here as equipment. The course of instruction is also to include summer camps in practical artillery work with the intention of so training the student that on graduation he will be commissioned in the field artillery reserve of the army.

At present Major Knight, U. S. A., is in charge of the Infantry and Commandant of the post. He is assisted by a corps of officers formerly connected with the S. A. T. C. and also by officers who have seen service overseas and in different parts of this country. It is expected that Lt. Col. Barton, '91, former Commandant here, will return as soon as his work as inspecting officer of the S. A. T. C. for the Eastern Department has been finished.

Several innovations have been introduced into the work already, notably the policy of Regimental singing on Friday afternoons. This has proven such a decided success that it is hoped the military authorities will continue it.

Drill is required of all of the Freshmen and Sophomores for three hours a week at present but plans are being formed to give credit to the men who have been in military service. Although the corps has started late the fact that most of the men have had some previous military experience makes it reasonable to expect that before inspection day comes around the corps will be in shape and that Cornell as usual will be on the list of Distinguished Institutions.

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**The Honor System** One of the best institutions of the College of Civil Engineering is the Honor System. It is popular with students and faculty alike. Every college man resents being constantly watched while he is taking an examination and there are few professors who do not loathe the job. For these



two reasons an honor system was established in this college in 1906 and it has been in successful operation for 12 years.

Every man in the college is a member of the system and it is the duty of the individual to support it. Violations of the "Code of Honor", which every man is expected to sign, are to be reported to the committee. The committee investigates each case and makes a recommendation as to the action to be taken.

The honor system is conducted solely by students in the College. The following men compose the committee: J. C. Gebhard, '19, chairman, L. G. Clay, '19, O. J. Sewell, '19, C. A. Stott, '19, H. H. Linnell, '20, J. B. McClatchy, '20, G. C. Williams, '20, F. W. Gumboldt, '21, T. W. Hoff, '21, and ——— ———.

January 14 Dean Haskell and J. C. Gebhard, '19, spoke to the men of the Freshman class telling them of the obligations and advantages of the honor system. Every man in the class has been visited by a member of the committee who, acting as a member of a college advisory committee, informed the Freshmen not only about the honor system, but also about college activities in general,—college athletics, the CIVIL ENGINEER, the C. E. Association, and the honorary societies. Every man of the 1922 class signed the code of honor. It is believed that this innovation was a decided success and that the visiting of the C. E. Freshman by the members of the honor system committee will in the future be a custom.



## FACULTY NEWS

Lieut. Col. O. M. Leland is with the 313th Engineers, a regiment of the Army of Occupation, in Germany. The regiment has seventy-five miles of highway and railroad to keep in good condition. Lieutenant Colonel Leland for some time acted as Colonel of the regiment. The officer who has recently been assigned to that command was a friend of his in Alaska years ago. Colonel Leland has been overseas since May and saw considerable real action in the Argonne.

Major Walter L. Conwell, '10, Assistant Professor of Highway Engineering, was transferred some time ago from the 307th to the 76th Field Artillery, which is at present a part of "the Watch on the Rhine." He was last heard from at Kottenheim, Germany about January first. Previous letters have reported some of the heavy fighting in which his former division, the 78th was engaged. Since the armistice was signed his regiment has marched through the Briey mining district of northern France and on to their present location. He reports that they experienced bitterly cold weather while marching through Conflans and Briey and that he was so unfortunate as to freeze three fingers on each hand.

Now that the war is over he is anxious to get back to teaching and his many friends join in the hope that his wish may soon be granted.

Captain Ernest W. Schoder, Ph.D., '03, Assistant Professor of Hydraulics is in Washington with the Engineering Department, preparing a manual of hydraulics for the use of the Engineer Army Officers, who have been graduated from West Point in two years. On completion of the manual Captain Schoder expects to return to Cornell.

Lieut. L. C. Urquhart, '09, is with the 215th Engineers at Camp Logan, Texas. He is topographical officer. Camp Logan is an engineers' camp and the men are rapidly being mustered out of service. Lieut. Urquhart himself expects to receive his discharge within a few days and will resume his duties in the College of Civil Engineering.

Lieutenant Carl Crandall, '12, instructor in the railroad department, who was serving as Pilot Instructor at San Antonio, Texas when the armistice was signed, has returned to college and resumed teaching at the beginning of the present term. Crandall enlisted in the air service last May and took his ground work at Cornell. He then trained in flying at various camps in Texas and Florida but was kept in this country as instructor upon completion of his training.

## ALUMNI NOTES

'90. J. H. Dickinson is Manager and Chief Engineer, Logging Dept., Lidgerwood Mfg. Co., and Vice-President of the Gulbransen-Dickinson Co., Chicago, Ill. His office is located at 96 Liberty St., New York City and his residence at Montclair, N. J.

'90. Thomas McE. Vickers is Secretary and Assistant Treasurer of the Syracuse Dry Goods Co. He is also Secretary and Treasurer of the Cato Mercantile Co., Cato, N. Y. He lives at 313 Maple St., Syracuse, N. Y.

'05. Edward Holmes has been transferred from the position of Efficiency Engineer for the Willys Overland Co., of Toledo, Ohio, to Terminal Engineer for the same company. He resides at 2844 Rockwood Place, Toledo, Ohio.

'09. James N. Kennan is District Sales Manager of the Aspromet Company, 170 Broadway, New York City. His home address is 461 West 159th St.

'10. Harry A. Augenblick, of 810 Broad Street, Newark, New Jersey, has recently been elected a member of the Assembly of the New Jersey Legislature.

'10. H. A. Kiep, Jr., and C. W. Decker '12 are in charge of the Industrial Finance Dept. of the Robertson Cole Co. of New York. They organized the department for the company, and are financing motor trucks. F. R. Oates '10, is also with the company. Mr. Kiep may be addressed at R. F. D. 55, Westfield, N. J.

'10. J. Alfred Stalfort is General Manager of the Building Department for the Consolidated Engineering Co. of Baltimore, Md. He resides at 3217 Carlisle Ave., and is an Associate Member of the American Society of Civil Engineers. He is also a member of the Engineers Club of Baltimore and the Cornell Alumni Association of Baltimore.

'12. John T. Child is Assistant Engineer of the Bureau of Municipal Research, 25 Main St., Rochester, N. Y. His Report on the problem of street cleaning of the same city was published December, 1918. Mr. Child was married to Miss Frances Underhill of Rochester, on June 19, 1918. He was a First Lieutenant in the Sanitary Corps, U. S. A., and was discharged January 25, 1919.

'13. Frank H. Burton is a First Lieutenant in Company C, 327th Battalion, Tank Corps, and William J. Fulton '12, is Second Lieutenant in Company B of the same Battalion. They trained at Tobyhanna and

sailed from New York, September 25, but arrived overseas too late to see any action. They were billeted in the same house at Brennes, France, on January 1st, and hope to return home soon.

'14. Guy F. Whitney of New Hartford, Conn., is Field Engineer with the Westinghouse Church Keir Co., New York Building, and is in charge of a power house at Torpedo Station, Newport, R. I., for the U. S. government.

'15. F. H. Rayfield announces his marriage to Valonica Adele Putman of Ashland, Kentucky. Mr. and Mrs. Rayfield are residing at 938 Prospect Place, Ashland, Ky. Mr. Rayfield is employed by the Kentucky Solvay Coke Company, of Ashland.

'18. Harry A. Wistrich is a transitman for the Lehigh Valley R. R. on the Mahoney and Hazelton Division, Hazelton, Pa. He resides at the Bachman House, Hazelton, Pa. L. H. Ryman '13, is Assistant Engineer in the same office.

## We Are Glad of the Chance to Renew the Acquaintance

Civil Engineering students were not a thing of the past but only a scarce thing due to the War. The Co-op. remained alive during the war and is in shape now to continue the good service of the past. Remember the Co-op. is your store.

**CORNELL CO-OP.**

MORRILL

ITHACA, N. Y.

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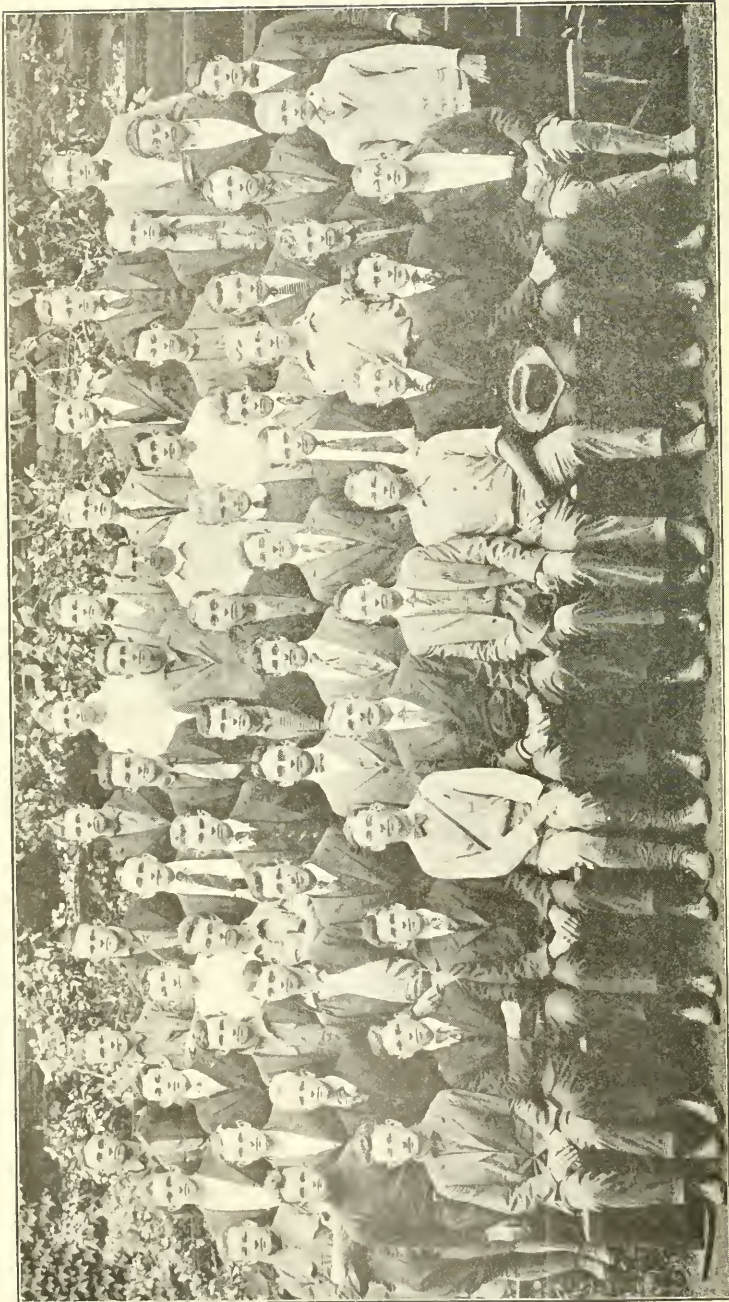
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*Courtesy of J. P. Troy*

C. E. Summer Camp Class of 1920

# THE CORNELL CIVIL ENGINEER

AND

## Transactions of the Association of Civil Engineers of Cornell University

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No. 2

### THE C.E. SUMMER CAMP—CLASS OF 1920

George D. Hayes, '20

Chief Engineer

Owing to the small size of the Sophomore Class, the increased cost of food and the difficulties in obtaining supplies and transportation under war conditions, it was decided to hold the annual Summer Survey Camp in the City of Ithaca, instead of camping along the shores of Cayuga Lake as has been the custom in previous years.

Lincoln Hall was used for headquarters and the students were permitted to obtain room and board wherever they pleased. The men were required to report at eight o'clock each week day morning ready for work in the field. Work lasted until five o'clock in the afternoon, with time for lunch at noon. A regular computing and mapping period was held every night except Saturdays and Sundays from 8:00 to 10:00 P. M., in Lincoln Hall.

This plan was entirely different from any other one in previous years. In 1912, the City of Ithaca was surveyed by the Sophomore class, but in that year a regular outdoor camp was established on West Hill.

This year the men missed all the pleasures, experiences and intimacy of outdoor camp life, thus rendering the Summer Camp rather dull and uninteresting from that view point, but this was made up in a large measure by the many advantages of living in the customary way on the hill.

The use of Lincoln Hall as a base of operations made it desirable to choose ground that was convenient to the campus for the practice work. In order that the survey might be of practical use, it was considered advisable to survey those districts in which there had been the most extensive changes in topographical features since the former survey of the city in 1912. It was therefore decided to survey the district known

as the Bryant Tract, which includes the area roughly bounded by College Ave., Dryden Rd., and Mitchell St.; Cornell and Cayuga Heights; and the new Barge Canal terminal and channels. In order to include sufficient area for practice work the boundaries were extended to the east and north rather than to the west and south, as the more open country in this direction afforded better field for work.

The purpose of the camp, as in previous years, was to give each student as thorough, theoretical and practical training in the important branches of surveying as is possible in the limited time of five weeks. Careful instruction was given in the following branches of surveying: topography, hydrography, triangulation, leveling base line, and astronomy.

The Camp opened on May 20, 1918, with a registration of 52 C.E. men and 13 Foresters. Ten men, whose records for Freshman surveying classes were the highest, were chosen by the faculty to act as captains of the parties. Each captain then made up his party of six men, who worked together for the entire course. The tract to be surveyed was then divided up into ten smaller plots in such a manner as to make each subdivision represent as nearly as possible an equal amount of work. It was the duty of each party to make a topographical survey of the plot assigned.

### TOPOGRAPHY

The topographic work was in the charge of Professors Underwood and George. The first day of Camp was spent in adjusting and determining the stadia constants of the instruments. After this was completed, the work of taking topography began and was continued until the end of the fifth week of camp. The stadia method was used in running control traverses and in locating topographic points. The traverses were required to close with an allowable error of one-half minute times the square root of the number of stations. Each member of the party took two sets of sun azimuth observations on some traverse line of the plot. These observations were used to adjust the traverse lines to the true meridian.

A topographical map to a scale of one inch to two hundred feet was made and traced by each party. These maps showed roads, streets, buildings, streams, railway lines, forests, the more important fence lines, ten foot contour lines, etc.

In addition to the larger plots, each party was assigned a smaller plot of about fifteen acres in the vicinity of the College of Agriculture. The control traverses of these plots were run with transit and tape. The elevations of the stations were obtained by spirit leveling, which furnished

a control for taking two foot contours. Details were filled in with the plane table. Corners of buildings were located by taping for distances, and by plane table for direction. Dimensions of buildings were obtained by direct measurement with tape and rod. Most of the other details were located by plane table and stadia. These plots were mapped to scale of forty feet to the inch.



Precise Leveling Near New Armory

#### TOPOGRAPHIC LEVELS

The topographic leveling was in the charge of Mr. McAnlis, and began the first day of camp. Spirit level circuits were run between previously located precise level bench marks, plot corners, and topographic level bench marks. These elevations were then used for the control of the stadia elevations of the plots. From six to twelve men were assigned to this work each day, and were divided into parties of two men each. So far as possible each man was assigned to this work for at least three days.

The circuits were approximately one mile long, and it was required to run out and check back in the same day. All circuits were required to check within an allowable error of closure of .05 times the square root of the number of feet in the circuit. The work was entirely completed by the end of the third week.

#### BASE LINE

The base line was located along a tangent of the "Auburn Short Line" just opposite the Remington Salt Works and had its respective northern and southern ends almost due east of the triangulation stations, "McKinney 1918" and "Salt 1918".



The preparation of the base line for measurement was rather difficult, as the line was thrown against the sides of several shale cuts along the right of way in order to keep the entire work clear of the passing trains. Stakes (2" x 4") equipped with strips of metal about four inches long, were driven on line at intervals of 50 meters. Auxiliary stakes were driven half way between the 2" x 4" stakes, with one face on line. On these latter stakes, nails were driven to support the tape during measurement. Topographic levels were then run over the line to determine the elevations of the tops of the main stakes and the nails on the auxiliary stakes.

The actual measurements were made by a party of seven men using the 50 meter Invar tape which had been standardized by the Bureau of Standards at Washington, and a special tension apparatus designed by Prof. Underwood. The tape was held under 15 kilograms tension and the distance marked on the metal strips with a needle. Temperatures were read from a thermometer lashed to the end of the tape.

A days work consisted in measuring up and back the length of the line, which was about 1050 meters long

#### PRECISE LEVELS

Beginning with the first day of camp and lasting until the end of the second week, two precise level parties of five men each were assigned to circuits each day, under the direction of the late Prof. Turner.

The organization of the parties was as follows: one instrument man, one note-keeper, two rodmen, and a man to carry the sun shade and adjust the level bubble. This last was by far the most popular job. The parties used the Berger precise level of the Coast and Geodetic type, and the Fauth precise level of the Wye type. The leveling rods were of the Molitor type with railroad spikes as turning points.

The circuits were layed out in the general shape of a large plus sign with its center at the U. S. G. S. bench mark at Lincoln Hall, and extending north and south, and east and west with the bench marks so located as to serve as controls for the topographic levels. A short line was run from the Lehigh Station north, to the east light house at the mouth of the inlet to the Barge Canal.

In nearly every case the day's work developed into a race (although it slumped into a chase) between the parties, to run out to the bench mark and return to the place of starting at Lincoln Hall. Due to the rivalry and the very fine weather conditions some very fast runs were made without sacrificing accuracy. The forward and backward runs were required to check within 4 mm. times the distance in kilometers



between bench marks, and no result, differing by more than 6 mm. from the mean of all the rest, was retained.

### TRIANGULATION

The triangulation net for the season's work resolved itself largely into a reestablishment of a system of quadrilaterals covering the southern end of Cayuga Lake. Due to the improvement of the Inlet in connection with the Barge Canal, and the construction of a new concrete breakwater leading to the Inner Light-House, station "Inlet 1912" was lost. Also due to the burning of the Remington Salt Plant in the latter part of 1916, station "Salt 1912" was buried beneath the rubbish of the



Control Traversing for Hydrography

building and no ties remained to make recovery possible. Station "McKinney 1912" was rendered useless because of an addition to the boathouse belonging to Ex-Senator Stewart. The unavoidable loss of these three stations coupled with the inability to relocate stations "Wait 1912" and "Tarbell 1912" necessitated carrying the work northward to stations "Sycamore" and "Finnish" of the 1912 work. This line serves as the connecting line between the work of the two seasons 1912 and 1918.

Four quadrilaterals were required to cover the lake area and connect with the previous work. Five additional stations were established to control the remainder of the topographic work back of the water front. In the location of two of these topographic stations it was advisable to make use of two lines established in previous years, namely the lines between Turkey Hill and Hungerford, and between Hungerford and Middaugh. This made a small portion of the net independent of the

base line work of the season, but time and men were not available to do the additional work that would have been necessary to have accomplished the tying in of the two pieces of triangulation.

Atmospheric conditions were unusually favorable for observation, as little haze occurred during the camp period. No occasion arose to use heliotropes as in past seasons. In addition to this no long sights were involved thus making the work easier. The only trouble experienced was in making observations on the signals located along the west shore of the lake where the shadows made it difficult to do good work during the afternoon.

From three to five parties, of two men each, were assigned to this work each day, under the supervision of Prof. Walker.

### HYDROGRAPHY

The hydrographic work, which was under the supervision of Prof. Turner, was divided into two classes, termed "inlet" and "lake" hydrography.

The "inlet" hydrography included sounding the channels of the Barge Canal from its mouth at the lake, south to the crossing of Buffalo street. Control traverses were run by the transit and stadia method along the banks of these waterways and a map of the same was plotted to a large scale. Two parties of five men each were assigned to the sounding work each day. The parties were organized as follows: one instrument man, one note-keeper, one rodman, one man to sound for depth and one man to handle the row boat.

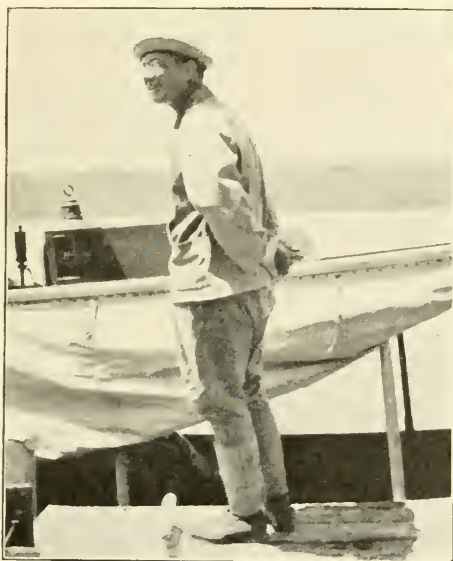
The soundings were made by the range method with ranges taken at intervals of fifty feet at right angles to the control traverse lines which ran along the banks of the waterways. The oarsman kept the boat on range by lining himself in with the instrument and a range pole placed some distance back of the instrument. Soundings were made at intervals of approximately ten feet when the contour of the channel bottom was regular, but in some cases it was necessary to take soundings every few feet along the bed of the channels, due to the deposition of silt since the last dredging of the channel. The distances were read on the stadia rod by the instrument man at each sounding.

All the topography directly adjacent to the banks of the channels such as boat houses, docks, piers, pilings, etc., was carefully located and plotted on the map. Each man was given at least one day of this work.

The first day of "lake" hydrography, which began as soon as the "inlet" type was completed, was spent in white-washing prominent rock faces along the shores of the lake to be used as shore signals for the sextant

readings. Following the establishment of these signals the regular work of deep sounding began.

The steamer "Senator Stewart" was used for this work with the sounding machine mounted on the stern. Approximately 500 feet of piano wire was wound on the reel and a sounding weight of about twenty pounds was used. Ranges were run across the lake at intervals of one-eighth to a quarter of a mile and the soundings were taken on range at intervals of from fifty to two hundred feet.



Professor Turner

The three sextant method of location of soundings was used on this work. Three signals were chosen and one sextant was used to read the right angle, one the left angle and the third the sum angle to afford a check of each location. These angles were recorded by the note-keeper who repeated them to the two men who were plotting with a three arm protractor. At night the locations and soundings were reduced to sea level datum and contours of the lake bottom sketched on the map.

#### ASTRONOMY

Each student was assigned to a station on the Library Slope and a reference point on West Hill for use in making star observations. One observation was taken on Polaris and one on Regulas, for computing the

true meridian of the line, the latitude and the time correction. This work was neglected by the men—as it usually is—until the last few nights, and then of course the sky was cloudy.

### CAMP NOTES

A few of the many laughable incidents happening every day to the faculty members and students are recorded here:

Prof. George is reputed to have told "Gus" Fay that there are but *six* correct ways of recording topographic notes but that "Gus" had recorded his in the *seventh* way. (but correct).

"Art" Fertel's party made the slight error of running a complete traverse on a neighboring plot.

"Eddie" Lenahan claimed to be the "All-American stadia computer".

Prof. Walker spent almost an entire day in the country waiting for the excitable Hirsch to hire a dray to move triangulation material from Johnson's boat-house.

Lallou, G. E. S. "Jr.", according to Mr. McAnlis carried other things than tools in the tool box of his Stutz. Prof. Burrows is said to be able to account for "three" missing from the bottom of the car.

Three men in succession received the order of the "Black Hand" while talking to the girls in the bag factory along the Lehigh tracks.

According to McClatchy stadia shots of 4000 feet were common in his party.

D party's map was finished in the "wee sma" hours to the accompaniment of "Benny's" violin.

It cost Engel \$1 to find his lost turning point in precise levels. Comstock was the lucky man.

One precise level party checked out O. K. in spite of Fitzpatrick's pulling out the backsight and then carefully driving it back with his heel.

Prof. Burrows entrusted the care of the Invar tape to "Matt" Hettinger with a "choicely" worded admonition not to let it leave his person.

"K" party claimed the original "lady killers" in "Dinty Moore" and "Al Smith".

Eddy and Hough checked within 9 ft. on topographical levels but "found" 6 ft. of it before ten o'clock that night.

According to Prof. Underwood "Pat" Collum and other members of his party slept more on the plot than they did nights.

### CONCLUSION

Exceptionally fine weather prevailed throughout the entire Camp period, as it rained but very few days; and in spite of the necessity of abandoning the outdoor camp the members of the class of 1920 thoroughly enjoyed the five weeks spent in Summer Camp.

The camp was under the supervision of Prof. P. H. Underwood, assisted by Prof. S. G. George, Prof. C. L. Walker, Prof. E. N. Burrows, Prof. K. B. Turner, and Mr. McAnlis.

The officers of the camp were: Geo. D. Hayes, Chief Engineer; J. H. Christian, Assistant Chief Engineer; the other usual camp officers were not chosen this year because of having no outdoor camp.

The writer wishes to express his thanks to the members of the faculty for their aid and data in preparing this article.



# THE ORGANIZATION OF A STANDARD MUNICIPAL TESTING LABORATORY

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## FOREWORD

This paper presents the reasons for, the fields of operation, and the organization of a standard testing laboratory for a municipality. It also offers the fundamentals for the design of such a laboratory. The paper is based on the writer's experience in several municipal, state, public utility and college testing laboratories. The methods of testing and the necessary apparatus have been standardized to a great extent by the national technical societies and so are not dealt with at any length here. The main points in the paper can be applied to a state highway laboratory, etc.

The paper was prepared upon a suggestion resulting from the writer's brief discussion\* regarding the "Final Report of the Special Committee on Materials for Road Construction, and on Standards for Their Test and Use", and because the writer has been continually aware of the absence and the need for such data as he here attempts to present. It is the intention to supplement this paper at some future time with a paper based on numerous "Notes on Laboratory Operation" (including forms and records and methods of collecting samples relating thereto) which the writer has compiled.

It is the hope that this paper will accomplish two objects:

- 1—Attract discussions that will be of value to the future growth of the municipal testing laboratory idea.
- 2—Stir up city officials (and even laboratory technicians) to realize the importance and possibilities for utilization of such a laboratory.

## INTRODUCTORY

A standard testing laboratory should be owned by every progressive municipality. The cost of the protection furnished by it over public purchases and the saving through the prevention of losses by overcoming many irregularities of usage is cheap insurance.

In private purchasing it is unwise to purchase, unless one is a fair judge of value, without the advice of someone familiar with the qualities of the thing bought. If without personal knowledge of the material

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\*Proceedings A. S. C. E., May, 1918.

or thing in question, it is natural to ask the judgment of an acquaintance who may be a competent judge of value to see that a fair return is obtained for a pecuniary outlay.

Likewise in industry, the sellers of materials know what firms check, weigh and test materials purchased, and they give their short weights and inferior goods to those who are not practicing the modern methods.

Experience has proved that the eye and the hand are no longer adequate to determine the quality of materials. The coal, iron and steel, as well as the glue, flour, etc., need chemical and physical analysis. Furthermore, in nearly every form of production, expert analysis is valuable in the process of manufacturing, for only thus can the insufficiencies be caught in time to prevent serious loss.

The problem of obtaining the best materials for use in public work is a big one. Rapid progress in the manufacture of materials, and the frequency with which substitutes are coming to be offered for acknowledged standards, makes laboratory control over the purchase and use of such materials especially important. First-class materials can be procured and their proper use can be ensured in no other way.

Proper standards aid in reducing the cost of work, especially those standards of materials and workmanship which can be maintained only with the aid of the laboratory. Not only should the materials purchased shade the minimum standards set up by specifications, but preference should be given to the best of those offered.

Testing has been considered only as a science to be occasionally used to determine the ability of a material to meet standard requirements. Rarely has it been utilized as a regular function to determine *relative* quality. Less often has it been the practice to utilize the knowledge of trained technicians on the laboratory staff to aid in obtaining the best usage from the materials after their purchase.

As usual, government has been slower than industry to acknowledge the economies which follow the scientific purchasing and use of materials. Laboratories have been developed by the federal government, by various states, and even by a few of our more enterprising cities. But the cases where the majority of the possibilities of a laboratory have been developed are negligible. Generally it is a matter of chance as to what men compose the organization or even that an organization exists whose function it is to do the work of testing. Moreover, its field of operation or scope of activities is narrow and irregular.

## DUTIES AND FUNCTIONS

The essential duties of a properly operated testing laboratory for any city are:

- 1—To develop uniform standards,
- 2—To establish a fair basis for the purchase of materials,
- 3—To obtain proper qualities in materials purchased,
- 4—To insure the proper usage of materials,
- 5—To reduce risk costs to both the contractor and the city,
- 6—To aid in the advancement of knowledge of materials.

Any municipal testing laboratory that fails to completely fulfill these duties neglects its useful field.

Clean cut competition, based on the contractor's ability to furnish the best of those materials desired can be obtained only by the use of clearly defined standards as set forth in the specifications and in their uniform and continuous enforcement by the testing laboratory. The Committee for the American Society of Civil Engineers in reporting on "Materials for Road Construction and on Standards for their Test and Use" (December, 1917) states, that "the description of a material by means of a trade name is permissible only in the most unusual cases and such a description as 'equal to' another similar material should never be used. Qualities of a material or methods of its use should not be left 'to the satisfaction of the engineer' or 'as determined by' or 'in the opinion of the engineer.' Specific tests and such description of methods of performing each test as will leave no room for doubt as to whether materials and methods proposed by a contractor will come within the limits of tolerance, should always be expressed in specifications, either in detail or by reference to the accessible standards of some reputable authorities". Thus has that national body placed itself on record in favor of unmistakable standards.

Many modern standards for materials have been developed by practical field experience and by laboratory analysis and research. Many of these standards have been set forth in the publications of our national technical societies. The consistent use of these, and other standards that should be developed by the local laboratory, establishes a fair basis for purchasing materials and reduces the risk cost to both the contractor and the city.

The laboratory's responsibility does not cease after it has determined which contractor has offered satisfactory materials. Able contractors realize the necessity for standards and not only willingly abide by the specifications but prefer to do so. Less scrupulous contractors, however, resent being held to the letter of the specifications and frequently find

some way to deviate from them. So it is evident that picking the lowest bidder, with the aid of the careful comparison of the values offered, does not end the laboratory's responsibility. It must insist that contractors honestly furnish the same standards of materials as they proposed with their bids. If this is not done the less scrupulous contractors readily can underbid their competitors and yet make large profits. If the laboratory does not prevent this, the able contractor is compelled to make similar substitutions or else fail to be able to bid low enough to obtain contracts. The municipality does not get what it pays for when such conditions exist.

Furnishing staff advice to the various municipal departments and bureau heads on problems of specifications, etc., is another laboratory duty which properly cannot be disregarded.

The degree to which the laboratory fulfills its duties is reflected in the service and life, not only of the materials, but in the public work in which they are incorporated. Excessive maintenance is necessitated if the materials are not of the proper grade so that materials which had a relatively cheap first cost ultimately become unduly expensive.

The supervision over the use of materials is not complete without the assistance of the laboratory. Ordinary inspection aids in directing the proper use of the materials in public construction, but too much reliance cannot be placed on "practical judgment" in the field, because too frequently this results either in unfairness to the contractors, to the public, or both. Inspectors often put faith in the policy of "give and take" to cope with any tendency on the part of contractors to "put something over". Moreover, field inspectors do not have the opportunity to understand the effects of certain neglects or misuses that to them appear minor and unimportant. This latter condition not infrequently applies to the contractor who may have good intentions. The most efficient method of ensuring the proper use of materials is for the laboratory specialists to co-operate with field inspectors, and thus not only protect the city but give valuable assistance to the contractor as well.

Many contractors justify themselves in slightly deviating from specifications when they furnish a guarantee on their work. This policy is not justifiable. Moreover, economy and fairness have made obsolete the practice of requiring a contractor to guarantee that the materials and products constructed by him, under specifications devised by others, will last for a definite length of time and render definite service. Such practice increases the first and ultimate costs of materials and work without any resulting benefit to those who pay the bill, because the contractor simply adds the cost of his guarantee to the cost of actual construction, and incorporates the sum of the two costs to him, (plus

a profit on both), as his bid price for the work. The retention of this guarantee money creates a false feeling of safety on the part of the city that the contractor will furnish the best materials or construct the improvement to the best of his ability. The following quotation is from a written statement by a prominent engineer and former contractor.

"It does not seem that at this late stage of the game it should be necessary for a city to exact a guarantee on any well-known type of pavement. City authorities have in their hands the drawings of the specifications for, and the full inspection of, all paving work; and to ask a guarantee, especially on a standard of well-known construction, would seem an admission of incompetence. . . . if in place of carefully drawn specifications and competent inspection, the five-year guarantee is substituted, the city may get a good pavement, again it may not. The odds are heavy that it will not. What it is most likely to get, when it relies on the five-year guarantee, is a pavement that will last five years and a day. And it should be added that usually the contractor has to make numerous repairs to the pavement in order that it may last the five years."

This same principle applies to all of the materials purchased by the city. The only excuse for using a guarantee is lack of faith by city officials and by the public in the specifications and in the system of inspection and laboratory control.

Moreover, according to law, if the methods to be employed in construction work are specified by the owner to the contractor, the contractor then cannot be held to guarantee the result of work done as according to those methods. The guarantee system originated when each contractor used his own "scheme" to perform work, and in many cities it is still adhered to in municipal work mainly because of inadequate supervision. The fact that methods have been standardized, that guarantee is an extra cost, and that adequate protection can be afforded by inspection (of which testing is a most essential part), makes it economically necessary that a testing laboratory do regular sample collection and sufficient analysis or testing to act as the staff control over the purchase of materials and over construction.

#### FIELDS OF SERVICE

The fields of service of the municipal testing laboratory are practically limitless. The first question that should be asked before entering any one field of service, or before expanding existing branches of service, is "What is the importance of this field relative to the others?"

The municipal laboratory usually originates in the engineering (or public works) departments because of the technical nature of the



work done there. For this work the laboratory should not only do routine testing but should investigate local sources of materials such as sand pits, stone quarries, etc. But the laboratory should expand from a purely construction or engineering laboratory into the city's standard laboratory and be under the supervision of the Board of Contract and Supply for the city. It should serve, not only the engineering field, but also the city's fire, police, water, purchasing, and other bureaus, shops, garages and utilities. For example, it should determine the relative value of the city's fuel, foods, materials of building construction, rubber for fire hose and firemen's boots, etc., etc.

Until the laboratory can be organized and equipped as a "Standard Laboratory" to handle the testing that is warranted by the entire field of municipal activities, the scope of the work will be mostly engineering testing. The question naturally aroused is how will the men be usefully employed during the winter months. If the letting of contracts is planned in advance, then many samples of materials will be received with bids for work during the early spring of the year. Investigations of materials and specification remodelling would fill in the partly vacant time freed by the curtailment of work in the late fall. In the beginning, the mid-winter testing may be confined to sewer work, for example, and the remaining time could not be more profitably applied than if used for research work. An example of this possibility is the determination of the applicability of magnetic testing of iron and steel. Determining the practicability of ideas received from the field and arising in the laboratory during the busiest times of the construction season, is another item of work properly belonging to the winter season.

As the volume of testing increases and the scope of the laboratory expands, occasional special studies will warrant even more highly specialized apparatus than is needed for routine testing. In order that such special work may receive accurate analysis, and, at the same time, that the investment in special equipment be made economical, it is recommended that the laboratory do some local commercial testing.\*

The laboratory then not only would serve all of the city departments but aid local industry. This would materially facilitate civic business, procure better materials for citizens, and would bring revenue to the city. The more frequent use of special apparatus would make its purchase economical. Experiments then could be performed that ordinarily would not be made because of the lack of facilities. The extra money and work to be done would be provided, thereby enabling the employment of highly specialized scientists in many branches of the

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\*In some cities a charter change or some form of state legislation is necessary to give the authority to do this.

work. In performing this function it is essential to keep all interests secondary to the official city requests, giving each class of work the relative attention that it deserves.

#### DEVELOPMENT OF PERSONNEL

The successful operation of any enterprise depends upon the personnel responsible for it. This is especially true of a testing laboratory. No matter what plans are adopted, they will be fruitless unless energetically carried into effect. Moreover, efficient growth depends upon the initiative and earnest effort of the laboratory personnel to cover its useful field.

Naturally a capable and experienced director is very important. He should be given money and authority to gradually build up a modern testing laboratory that will properly safeguard the city's interest. If he is qualified to determine the relative value of expenditures and purchases for the city, he is fit to be trusted with an expense account ample enough to enable him adequately to cope with the ever-changing conditions in his work. The director should not be restricted by any influences except limitations similar to those placed upon a thoroughly business-like, energetic manager of an industrial enterprise. This is no more than fair to the taxpayers whose public purchases he would endeavor to safeguard, improve and cheapen. The testing laboratory, rightfully considered, is a municipal business enterprise in which the taxpayers are the stockholders. The laboratory director is the manager of the enterprise by right of his special knowledge and experience. Not only money, but authority to spend it must be allowed him. Dividends in the form of decisions as to the best materials are the economic products.

On the staff of the laboratory, in addition to the *director*, should be specialists in the various branches of science used in the testing of materials. For example, a *chemist* is needed to attend to the testing and aiding in the proper usage of bituminous materials, to analyze gas, water, coal, sewage, gasoline, rubber, explosives, etc. A *civil engineer* is required to test paving, building, and other construction materials. An *electrical engineer* is needed to test and experiment with the street lighting system, etc. A *mechanical engineer* will be needed to take care of tests on such things as structural materials and machinery, when the volume of such work increases enough to unbalance the regular duties of the civil and electrical engineers. Later, when the laboratory expands to include the bureaus of health and public safety, a *specialist* in sanitary chemistry will be needed to test foods of a special nature or over which there is a controversy and to assist the police bureau to solve

poison cases and other such problems. The *textile expert* should determine the paper and binding best for use in school books, etc.

One of these specialists should be designated as the *principal assistant* to the Director and instructed to assume charge of affairs during the latter's absence. It is not necessary that this man be the one receiving the highest salary or having been employed longest; ability should be the determining factor.

Another addition to personnel that as yet has not been considered by laboratories in general, is a corps of inspectors for collecting samples. The laboratory should not wait for samples to be sent in for tests but should arrange for their systematic collection. This calls for the development of an organization to collect them. Usually it has been the custom for field inspectors assigned to the particular job to collect the samples from it and, by various means, to send them to the laboratory. This not only leaves the collection of samples to chance, but just as experience has proved the inadvisability of leaving to the field inspectors the determination of quality of materials, so it is true that field inspectors seldom are qualified to select samples for varying grades of materials. The only safe and sure procedure is to have trained laboratory men go into the field and collect all samples. This is in direct opposition to the now obsolete theory governing the policy of many laboratories: that the tester should know as little as possible of the source and identity of the samples.

The inspection (or sample collection) corps should be headed by a *chief inspector* who should see that the work of each of the laboratory specialists receives the relative attention due it. Besides collecting samples it should be the duty of the collection organization to keep laboratory records of contracts advertised by the city, bids and materials received, contracts awarded, work about to be begun, construction in progress (by the use of a graphic progress chart, etc.), and jobs completed. As will be shown later, this would be an invaluable aid in planning the laboratory work.

The collection organization is of great value in other respects. By its use laboratory control of materials is more complete, and field inspectors can be instructed in the proper use of materials. Certain of the inspectors should be stationed at asphalt plants when in operation, also at local plants of local manufacturers of brick, tile, etc., thereby ensuring better plant control and also aiding the laboratory in checking or rather inspecting the output of such plants. Moreover, complaints arising from the field or from property owners as to the character of materials and workmanship, can readily be investigated by the laboratory inspectors, independently of the regular field inspectors.

Incentive for field inspectors and, at the same time, which is very important, a nucleus for a future laboratory staff, will result if the laboratory inspection (or sample collection) corps is selected by merit, whenever possible, from the best qualified men in the construction (or field inspection) corps. Such men, if they have the necessary professional qualifications, become fitted for the laboratory inspection corps because of their experience and training by the present laboratory inspectors in the use of materials. Also they frequently merit further promotion to regular staff positions in the laboratory. Laboratory inspectors who do not have the essential professional qualifications, can be transferred when conditions warrant it to some other branch of the technical service, such as the Engineering Department, or the Department of Public Works, etc.

Because of the usual increase of work for the collection corps during the summer construction season, it is good policy to employ a few students from advanced technical schools during their summer vacation, to aid in the gathering and routine testing of samples.

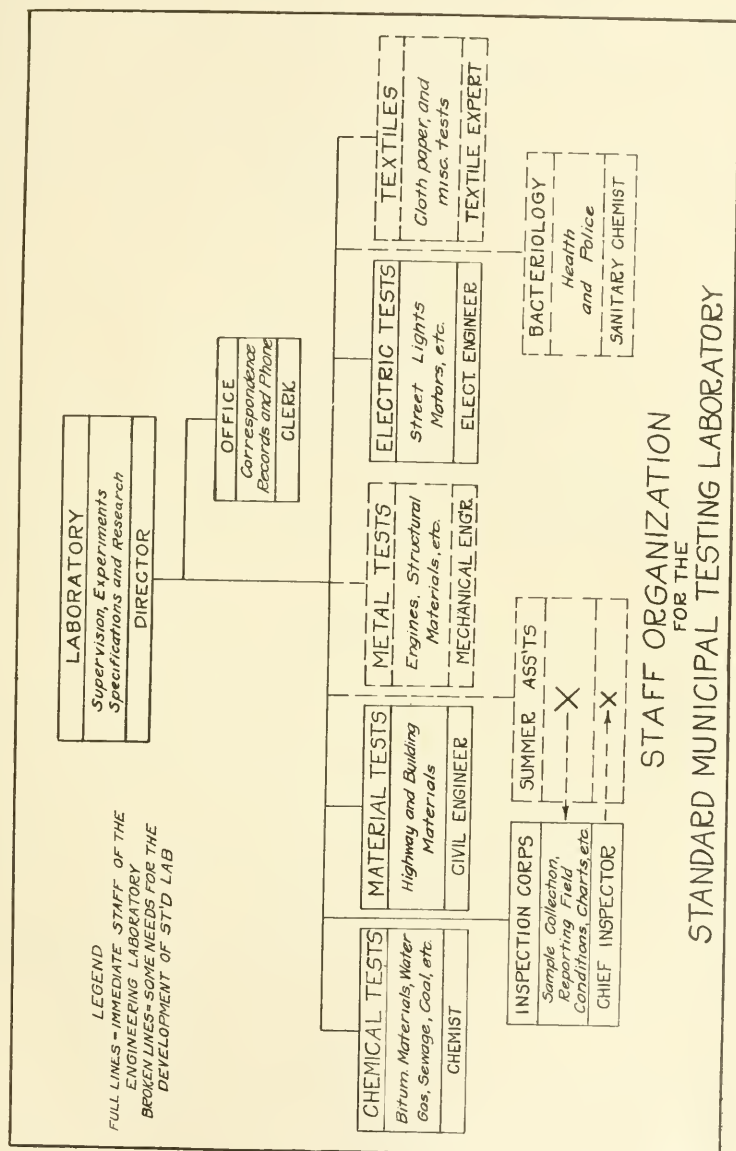
A stenographic clerk is needed in the laboratory in order that clerical work may not consume time properly applied to scientific work; for the experts should not stop their important duties to typewrite records, reports, letters, etc.

Civil service is necessary to ensure a stable organization for the laboratory. Clearly defined requirements for staff positions should be set up, and provision made for advancement both in salary and position as a reward for meritorious service. This is the only way in which capable and energetic men can be attracted, on the one hand, and in which political interference can be prevented, on the other. Tentative requirements for a few of the various positions in the laboratory staff are suggested as follows:

The laboratory *director* should be at least thirty years of age; he should be a chemist or civil engineer, having graduated with a degree from a college of recognized standing; and should have at least five years' experience in testing and using the majority of the materials cared for by the laboratory. He should have the demonstrated ability to plan and to direct the work of men.

The *chemist* should hold a degree from a college of recognized standing, and he should have at least two years' experience in the standard methods of testing and using such materials as bituminous paving materials, water for municipal consumption, gas, coal, sewage, rubber, explosives, gasoline, etc.

The qualifications for the other men should be developed along these lines. The specifications and requirements set up for positions in the





Central Testing Laboratory of New York City offer a good basis for further development, but they are not thought to be complete in many respects.

The organization above outlined is graphically represented on the preceding page. The number and type of specialists mentioned are not necessarily all of those needed; those mentioned are the ones generally required for engineering work but do not include the men needed to attend to textiles, etc., as will be required as the laboratory expands to more fully cover its proper fields.

#### PHYSICAL DEVELOPMENT

##### *Arrangement*

The size and number of rooms required for laboratory purposes is a matter which must be determined differently for each case. In some cases the laboratory may be started in three or four rooms in the basement of some public building; but in any event it should be kept in mind that by the time it has developed to fully care for its proper fields, the laboratory will require not only several rooms but several floors of a building.

A basis for determining the number of rooms and their arrangement is given by the following items; the entrance into the laboratory should be through or by way of the office. This will prevent visitors from walking promiscuously through the laboratory and interrupting work. Sometimes the objection has been raised that by having the entrance room the office, it is impossible to keep the room clean, because of the frequency with which bulky and dirty samples are brought into the laboratory; for this reason it is best to have a side door or hall-way entrance opening into an alley-way, so that samples may be taken in by it, and thus not dirty the office. However, the objection is minor and should not prevent the office from being the entrance room.

The office should contain desk room for each man; a large table to be used for computing data; a folding drawing table; plenty of space for record files; cabinets for delicate apparatus and book cases.

A special room is needed to contain apparatus and chemicals for testing bituminous materials, etc. Such a room should be amply provided with gas hoods and ventilating fans. It is also very good practice to have a gas-tight enclosed shelf in the center of the chemical testing room in which should be kept all bunsen burners and other apparatus which may ignite inflammable gases. This shelf should be enclosed with glass windows which can be opened to allow the entrance and removal of materials as needed; it should have several connections for

water and gas and should be covered with a water and fire proof material (such as galvanized tin); and should be ventilated at the top by means of electric fans opening to the free atmosphere. The centrifugal machines used for washing bituminous mixtures should be located at some distance from this enclosed shelf in order to prevent carbon-disulphide vapors from reaching the bunsen burners.

Another room should be allotted for use in testing sand, cement and concrete. It should contain storage racks and ovens for briquettes, cubes, etc. Another room may be needed for electric testing and will require electrical meters, switch boards, transformers, lamp racks and motor connections.

The brick testing rattler machine, the Deval stone machine and the coal testing apparatus are best located in the cellar, as should be all other large and heavy crushing and grinding machines also.

A stock room is essential to contain a good supply of chemicals and other needed materials required over a given period.

Unless the laboratory is very large, it is not thought economical to equip a room as a machine or carpenter shop, because ordinarily the tools needed for minor repairs to apparatus can be obtained from the municipal shops.

### *Equipment*

Most of the testing procedures have been standardized enough to warrant the manufacture of standard apparatus and testing equipment to replace the "make-shift" equipment, which was formerly customarily prepared in laboratories. Standard apparatus saves time and enables the tester to obtain more accurate results; and by its use the "personal factor" is largely eliminated and data and results obtained are more easily duplicated. Considerable apparatus is necessary to perform standard tests by standard methods and in order that its purchase may be economically made, it is suggested that it be purchased in installments of comparatively small lots. Once the laboratory becomes properly equipped, it should be kept so by a system, whereby a definite quantity of apparatus is obtained each year.

Apparatus that has become obsolete due to improvements in methods of testing, etc., should not crowd and overburden the laboratory, under the excuse that it may "come in handy." Apparatus out of repair should be put into workable condition at the earliest possible moment, in order that tests may not be delayed. Improper care of equipment will result in rapid deterioration; delicate apparatus should be kept in specially designed cases. Some of the spare time of the laboratory men should be utilized to inspect the apparatus periodically.

A library should be considered properly as part of the equipment of a testing laboratory. The most important working tool to any professional man is a complete reference library. It is important that a scientific man develop methods and understand principles and laws, but the details and data attached to them should not clog his brain; thereby hindering clear thinking. He should be familiar with the details however, and should know where to find them, and have books containing them readily accessible.

The library should be kept up-to-date with the latest editions of technical books of a wide range of subjects. It should be the object to collect books containing specific data. Books of a general nature need not be had in the laboratory, but it is advisable to have a list of such books that may be found in the local libraries.

Technical magazines are an important item in the library. The laboratory director should make it his duty to obtain and study all information published in the leading technical journals, and the men should be required to devote a specific amount of their time in following their fields as covered by certain of the magazines. The magazines should be referenced and bound for the future use of the laboratory specialists.

#### ESSENTIALS OF OPERATION

##### *Co-operation*

One important factor that can aid or greatly hinder the success of the laboratory is the degree of co-operation given by the city officials, field engineers and city purchasing agents whose duties are related to the work of the laboratory. These men should adhere to the strict policy of obtaining the laboratory's approval and endorsement before accepting materials and before permitting their use. Contractors should be forced to promptly notify the laboratory of the arrival of materials, and then to respect its findings.

An example of how this co-operation should be cared for on the part of the specifications, so that the related persons may have a definite basis for co-operation, is indicated by an extract from the "general provisions" for the division of the specifications dealing with "materials" for use in "local improvements" (that the writer recently assisted in preparing for the city of Rochester, N. Y.) as follows:

"1. All materials shall be subject to the approval of the Engineering Testing Laboratory. Before any construction work, which includes the use of any materials covered by these specifications, is begun, the contractor shall obtain the official written permission of the Engineering Testing Laboratory, endorsed by the Engineer, authorizing the use of

such materials. Failure to obtain such written permission shall be considered proof of the inferior quality of the materials in question.

Furthermore, if tests made after such materials have been used in the work shall prove conclusively that they are of inferior quality, then the Engineer may order all work which includes such materials to be torn out and replaced with approved materials at the Contractor's expense; or, if the Engineer shall deem it for the best interests of the city, he may direct that deductions be made from moneys due or to be due the Contractor, in sufficient amount fully to compensate for the inferior quality of such materials".

The specifications in several places, call for the contractor to submit samples of the materials in question with his bid. Now it is seldom that a contractor can do this for all, or even most of his materials, simply because he does not know who or where he will get all of his materials from if he is awarded the contract. Therefore a clause is provided in the "Instructions to Bidders" which reads:

"Attention is especially called to the General Provisions of Division 'B' of the specifications relating to materials. Samples of all materials to be furnished in the work shall be submitted with the bids in accordance with the specifications, *or* the Contractor shall obtain written instruction (in duplicate) from the Testing Laboratory before making his bid, as to when and where such samples shall be submitted, and shall include a copy of such instructions in with his bid."

### *System*

The regularity and promptness of testing is another factor affecting the success of laboratory operation. System is required to insure the daily performance of duties, to make sufficient plans to properly balance duties and to give to any one item the attention which its *relative* importance warrants. It is necessary, in order to plan for work in advance, that charts and information of the nature suggested when the laboratory's corps of inspectors was discussed, be utilized. The laboratory should make daily itemized work schedules by the use of the work plans; by insisting that contractors give ample notice before beginning various phases of work; from report cards sent in by the field inspectors; or by written reports of the field engineers and city purchasing agents; and by other means of co-operation. These schedules should be rigidly adhered to, and only deviated from by force of dire emergency.

Without a work schedule, or with one that is but partially enforced, the writer has observed that samples frequently were not collected in time or that test results were obtained too late for use, or were so late as to materially delay and interfere with the work schedule of the contractors. Furthermore, but a limited amount of work could be handled

and even that amount was hastily and incompletely performed. What happened was simply that the multiplication of duties was allowed to become a complication.

The work schedule should be checked by records of work done from day to day, thereby giving data on which to base plans and from which to prepare a yearly budget and other tabulated information essential to the development of the laboratory.

Records of all tests made by the laboratory during the past five years should be referenced on file. Law suits which have developed from disputes by contractors have been settled by such reliable facts.

Interruptions by visitors should not be tolerated; only essential interviews with the laboratory employees should be permitted, and those by appointment only, the time then being set so as not to interfere with the work schedule. All requests should be made in writing or by telephone, for otherwise the constant interruptions to tests in progress would make it a physical impossibility to care for the work or to obtain reliable results.

It may appear unessential to remark that although personal liberty within reason is always permissible, that it should be curtailed when it causes the neglect of regular duties. The writer has observed in some laboratories that the men constantly use their working time for personal affairs; they do their shaving, develop personal photographs, construct petty articles for private presents, and waste time on many other unofficial matters. The nature of the laboratory work breeds such habits in certain types of men. Of course, this is an affair dependent upon the laboratory director.

Another caution is that tests in progress should not be set aside in order that promiscuous ideas that have occurred during their progress be followed out. A record of such ideas should be made, however, and they should be followed up at such times as the director may determine; preferably during the winter season.

### *Utilization of Results*

The data obtained from tests may be utilized in many ways. Attention has been called to the inadequacy of the practice of testing materials with the idea only that they must pass the minimum requirements of the specifications. For some types of public works and materials, with our present limited knowledge, this is all that can be expected. However, whenever it is practical, the policy of the laboratory should be to give preference on the basis of relative quality; and in many cases weighted payments should be made, based on average or relative quality. In any case it should base such weighted payments on the relation of the furnished materials to the quality of the original sample



and percentage deductions should be made for payments of certain classes of materials (according to definite specifications) when tests show them to fall below a specified average (not minimum) quality. When the laboratory expands to supervise large numbers of purchases, such a policy will result in material savings to the city and also greatly increase the average value of the goods purchased.

Another very important use to which test data should be put is to arrange it in tabular form showing how materials and the structures in which they were used compared as to quality and according to the contractor furnishing or doing the work. This practice is an easy proof to the "practical" contractor who for example, uses too much water in his concrete, that he must improve or fall below the standards of competitors and thereby lose prestige. This use of the data results in marked improvements in both the quality of materials and in construction practice and repays the effort and expense of it. Moreover, such a table furnishes the city's Board of Contract and Supply (or similar body) with the data which it needs to weed out the unscrupulous contractors.

### CONCLUSIONS

Among the main conclusions developed by this paper the three following are most important:

1—A standard testing laboratory is an economical investment for any municipality.

2—Seldom are its advantages more than partially utilized.

3—Its field of service is of almost unlimited expansion.

Furthermore, human performance always lags behind human knowledge and it is the duty of the municipal laboratory to urge local practice to closely approach scientific knowledge. Real efficiency or economy cannot be obtained through mushroom growth but developments must come through a gradual and earnest effort fully to cover its useful field. Occasional testing is not sufficient to insure proper value or usage of materials. Investigations must be based on knowledge gained through experience, scientific observation of conditions, accurate analysis and practical interpretation of results obtained.

The field of usefulness is possible of further enlargement by the ready adoption of improved methods and through scientific experiment and research. Specifications for materials must be constantly improved; obsolete parts must be weeded out and others made to conform to advanced methods. Not only should the laboratory follow the recommendations of the national technical societies but it should of itself contribute toward the advancement of that service. To be ever unsatisfied with conditions and to make every effort to improve them is the only policy by which progress will be made.

# THE CORNELL CIVIL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR BY

The Association of Civil Engineers of Cornell University  
Ithaca, N. Y.

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## EDITORIALS

### Board

### Elections

The Board takes pleasure in announcing the election of E. J. Sherk, of Harrisburg, Pa., and E. P. McKee, of Scranton, Pa., to the Sophomore Editorial Board, and E. F. Chobot, of Brooklyn, N. Y., and R. E. Pratt, of Franklinville, N. Y., to the Sophomore Business Board.

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### A Comment

It is very easy to satisfy one's desire for war stories with the flood of this literature that is being published, but we never seem to hear enough of the experiences of those whom we are directly interested in. Perhaps it is due to the censor, the modesty of the writer, or the fear that his experiences might seem commonplace and not very interesting in comparison to the most glorious of war experiences.

However, the element of personal interest or common interests tends to make these comparatively unexciting occurrences and routine work far more fascinating than the most vivid war tales. Alumni of the early

days look with expectancy to the accomplishments of the classes of later date; classmates have a personal interest in the welfare and work of each other and the undergraduate reads with encouragement the experiences of all alumni.

The purpose of THE CORNELL CIVIL ENGINEER is to maintain these lines of common and personal interest between the widely scattered men of Lincoln Hall; so do not wait for a special request to send in accounts of your experiences and reports of your work.

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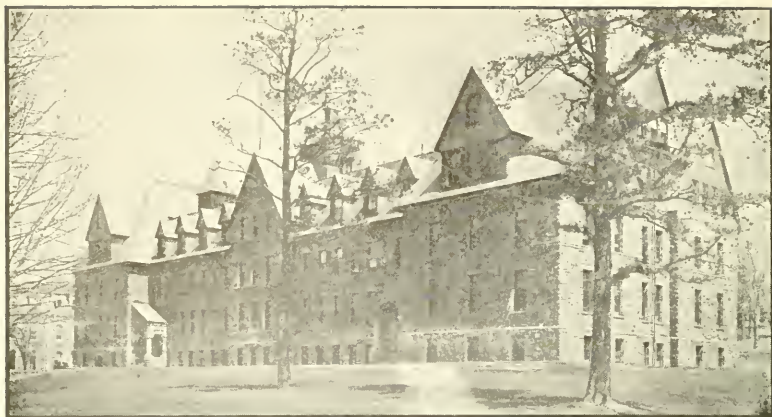
**Municipal  
Testing  
Laboratory**

Despite the advance in knowledge and standardization of building and manufacturing materials, municipalities continue to suffer from losses incurred by ignoring the proper inspection and testing of materials purchased for public use, and from lax methods of awarding and watching public contracts. The question follows, "What protection must be furnished to insure the overcoming of these irregularities?" On page 51 of this issue, Mr. J. O. Preston gives as a solution of the problem, "The Organization of a Standard Municipal Testing Laboratory". The paper discusses the large field of operation and development possible for the organization and presents the working out of the development, and essentials of operation. The degree of efficiency of these factors combined with the support of public officials, determine the success and growth of the laboratory.

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**A Correction**

The portraits of the late Andrew D. White and Professors A. P. Mills and K. B. Turner, printed in the February issue, were published by the courtesy of the Robinson Studio. Through an error credit was given to the White Studio.



## COLLEGE NOTES

### Track

### Prospects

The varsity track team at present, while not up to the pre-war standard is nevertheless showing better form than the 1918 team which won the Intercollegiates last year. Most of the members of last year's team are already back and Dresser, captain-elect of the team is expected back next term. Meets have been arranged with Pennsylvania and Annapolis for the early part of May and this will give the men some competitive training before the Intercollegiates which will be held on May 30 and 31st. A large number of men are reporting for practice daily and prospects of a repetition of last year's victory seems bright.

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### Spring Day

Spring Day! To most of the present undergraduates it is only a name. To the Senior class and the Alumni, however, it brings back many fond memories. The fame of Spring Day spread wherever the name of Cornell was known. With our entrance into the war in 1917 all plans for The Day ceased. A Spring Day in 1918 was of course out of the question, but now with the cessation of hostilities, plans for 1919 are being rapidly formulated.

It is hoped that many of the Alumni will return for Spring Day this year but indications are that it will be mainly an undergraduate affair, as most of the Alumni will probably defer returning to Ithaca until the Semi-Centennial Celebration on June 21st. Spring Day, which will take place on May 24th bids fair to rival days of the past. A mammoth circus will be held with the usual and also some unusual attractions. In the afternoon the baseball team will play Yale, and at sunset the crew will row against Annapolis.

It was originally planned to hold the Semi-Centennial Celebration last fall but due to war conditions it was thought advisable to postpone it. At this time the Ezra Cornell Statue will be unveiled with fitting ceremonies. In the afternoon of June 21st the baseball team will play Pennsylvania. Reunions of all the classes are being arranged.

Let the auspicious start that has been made in Cornell social life by the "Housewarming" of the New Armory of March 8th be carried on by a thorough support of Spring Day.

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**Prospects for  
Baseball** Cornell's baseball schedule has been officially announced for 1919. The schedule consists of eighteen games, eleven of which are to be played at Ithaca. The season opens on April 19, when the varsity meets Lafayette on home grounds.

As Spring Day comes on May 24, one of the chief attractions will be the game on Percy Field with Yale.

Last year's "C" men who have returned are L. A. Corwin, L. H. Cross, J. H. Harden and H. P. Murphy.

A championship team will largely depend on the showing of the battery candidates, as J. Needle is the only pitcher left from last year's team and no veterans have returned for behind the bat.

The schedule is as follows:

- April 19—Lafayette at Ithaca.
- April 26—Bucknell at Ithaca.
- April 29—Open at Ithaca.
- May 2—Columbia at New York.
- May 3—Princeton at Princeton.
- May 6—West Virginia at Ithaca.
- May 10—Colgate at Ithaca.
- May 14—Lehigh at Ithaca.
- May 17—Colgate at Hamilton.
- May 24—Yale at Ithaca.
- May 28—Rochester at Rochester.
- May 31—Open at Ithaca.
- June 4—Rochester at Ithaca.
- June 6—Brown at Providence.
- June 7—Yale at New Haven.
- June 14—Penn. at Philadelphia.
- June 21—Penn. at Ithaca.
- June —Dartmouth at Hanover.



## A LETTER FROM FRANCE

Headquarters, S. O. S., U. S. A.,  
TOURS, France, Dec. 21, 1918.

*Cornell Civil Engineer:*

I am enclosing a picture which shows that even the old boys of the class of 1884 have been doing their bit in this war.

Major Decker is a good instance in refutation of the frequently published assertion that "square pegs are always put in round holes". His long experience as a patent lawyer is being utilized to investigate and evaluate the claims of patentees whose inventions have been used by the U. S. Gov't over here. His work will save the Government untold thousands of dollars.

And I also have been utilized in my specialty—as an engineer. It has been necessary to lease thousands of buildings and tens of thousands of acres of land. As an instance, one tract alone contains about 7500 acres. Sometimes the leases can be made by "amicable" agreement. Frequently the only possible amicable agreement is at an outrageous price. Fortunately for us, the French Government has given us the power to "requisition," which means, practically, to take the property anyway and settle afterward at an assessed valuation. But whether the property is *rented* or *requisitioned*, there is invariably a huge *claim* for alleged damages, or indemnity, in addition to the mere rental value. And so there has been organized the "Renting, Requisitions and Claims Service." Of course the work is largely legal and a large proportion of the officers in this service were lawyers in civil life, but the proper valuation of buildings and lands and particularly the estimation of damages and claims is technical matter and I am very proud to have the honor of signing my name to valuation estimates over the title of "Chief Engineer, R. R. & C. Service."

I have just received a copy of the May issue of the CORNELL CIVIL ENGINEER in which is quoted the letters of Mossman, '14, and the account of his heroic death. The plain, unvarnished account of his heroic work in Flanders mud makes our own work here seem very tame and makes us old fellows envious but 1914—1884=30 years, and we are thankful that we have been permitted to come over here and "do our bit"—not in exploits of spectacular heroism in the trenches—but in that routine work "at the rear" which is essential.

I was in Paris during the winter of 1917-18 and have frequently experienced the explosions of bombs from aeroplanes striking uncomfortably close to where I was, and trying to be philosophical as to the chances that the next might be *too close*. On the first day that the

Germans fired their long-distance gun on Paris, I was at the very top of the Eiffel Tower, by special permission of the Minister of War.—the first permission that had been granted since the beginning of the war.

The Germans were so anxious to hit and destroy that tower that they spread a report in Berlin that it had been destroyed. At first the French were incredulous that any cannon could shoot that far and believed that the shells came from some aeroplane which, in some mysterious, inexplicable way, was able to keep out of sight. But that day was beautifully clear and not only were there French officers on top of the tower, search-



ing the sky with powerful telescopes, but there were also numerous French aeroplanes circling around to discover any German plane that might be hidden by clouds from the earth. But still the bombs dropped at perfectly regular 20 minute intervals and the French were then convinced that it was a cannon. Of course it would have been a marvellous fluke to have struck the Eiffel Tower at a distance of about 70 miles, but it also would have been something of a drop for me.

On that same afternoon an American officer was walking in the Tuileries Garden. A sort of sixth sense impelled him to instantly flatten himself on the ground, and as he did so he was splashed with dirt. A "gros Bertha" shell struck the soft ground about 100 feet from him and on account of striking soft ground there was no material damage. But

on the following Friday—Good Friday—the Boche showed what a loathsome pariah he has become.

And so, although I have heard numerous German shells and bombs and have seen the damage they have done, I have no “wound stripes,” and have not been gassed or shell shocked. But I am very glad that Cornell, '84, has been permitted to have even this much participation in the Great War.

Yours very truly,  
WALTER LORING WEBB,  
Chief Eng., R. R. and C. Service, U. S. A.

## ALUMNI NOTES

'72. Rufus B. Howland after teaching for 44 years at the Wyoming Seminary has now retired to a small farm in Trumansburg, N. Y.

'72. Seymour T. Thomas has retired but is not located permanently at present. He may be reached thru the address: Care of Phoenix Iron Co., 49 William St., New York City.

'73. Henry E. Blake is with the New York State Highway Department as Assistant Engineer and is stationed at 53 Lancaster St., Albany, N. Y. His home address is Elsmere, N. Y.

'73. Fred J. Knight resides in Monroe, Orange Co., N. Y.

'74. Fred B. Alexander is with the Rattan Manufacturing Co., at Allston, Mass. He is residing at 606 California St., Newtonville, Mass.

'74. F. C. Tomlinson of 721 Park Avenue, Ironton, Ohio, writes that he is now a "gentleman of elegant leisure" and that he is not trying to "stir up" anything until things settle down.

'77. Theodore Luqueer Mead is a Horticulturist at Oviedo, Fla.

'80. R. W. Havens is a Civil Engineer with an office at No. 1 Broadway, N. Y. C. He resides at 247 E. 32d St., Brooklyn, N. Y.

'81. Henry W. Battin of 220 Ave. F, Billings, Mont., was in the Spruce Production Division of the Aeroplane Service. He is now engaged on Bridge Construction at the Olympian Peninsula, Washington.

'81. Jesse E. Read of 448 Kosciusko St., Brooklyn, N. Y., is Assistant Engineer for the Finance-Department of the City of New York.

'84. E. C. Murphy is Hydraulic Engineer for the U. S. Geological Survey, with headquarters at Napa, California.

'85. Geo. W. Powell is County Engineer and is residing at Canandaigua, N. Y.

'88. C. W. Curtis is Advertising Manager for the Sill Stove Works, Rochester, N. Y. He resides at 17 Melrose St., Rochester, N. Y.

'88. S. L. Etnyre is Superintendent of Water Works for Council Bluffs, Ia.

'88. William S. Farrington of 359 Norwood Ave., Buffalo, N. Y., continues as President of the General Flour and Feed Co., with offices at 18 Letchworth St.

'91. Carl E. Davis is Hydraulic Engineer for the Artesian Water Dept. of Memphis, Tenn. His address is 1002 Monroe Ave. He is a member of the Memphis Engineering Club.

'93. E. P. Boynton is a manufacturer. He resides at 852 2d Ave., Cedar Rapids, Ia.

'93. William Brown reports that he is farming at Belvidere, N. Y.

'93. Theodore W. Hill is farming and contracting in Bellfontaine, O.

'94. Irvin W. Barbour is Principal Assistant of the State Highway Commission, State House, Augusta, Me. He was President of the Maine Society of Civil Engineers for 1918. His home is located at 28 Belknap St., Portland, Me., (P. O. Woodfords Station).

'94. W. P. Boright is residing at Chatham, N. Y.

'94. Herbert William Strong is Secretary for the Strong, Carlisle & Hammond Co., of 1392 West Third St., Cleveland, O. He is residing at 1939 E. 90th St., of the same city.

'96. D. Y. Dimon gives his residence as 315 Paulison Ave., Passaic, N. J.

'97. Ira W. McConnell and H. Gage Balcom have resigned from the Division of Ship Design and Production, American International Shipbuilding Corporation, Hog Island, Penn.

'98. Walter H. Gelder is Engineer of Maintenance and Way for the Ashland Coal and Iron Railway Company of Ashland, Kentucky. He resides at 704 East Montgomery Ave., Ashland, Ky.

'99. Ernest D. Button, of 449 N. Aurora St., Ithaca, N. Y., is President and Manager of the J. B. Lang Engine and Garage Co., 117-129 E. Green St.

'99. A. U. Whitson is City Engineer for Flushing, N. Y. His residence is at 307 State St., Flushing, N. Y.

'99. E. E. Lanpher is Division Superintendent of the Distribution Division of the Pittsburgh Bureau of Water with offices at the City-County Bldg. His home address is 5645 Callowhill St., Pittsburgh, Pa.

'99. Friend P. Williams is Special Deputy State Engineer in charge of New York State Barge Canal. His mail address is care Barge Canal Office, Albany, N. Y., and he resides at 115 Delaware Ave.

'00. Leon D. Conkling is Professor of Civil Engineering, Montana State College, Bozeman, Montana. His residence is at 516 S. Grand Ave., Bozeman, Montana.

'00. E. W. Gehring of 40 Deering St., Portland, Me., is a physician with offices in the Y. M. C. A. Building of Portland.

'00. Charles W. Landis of 14 Hamilton Ave., Cranford, N. J., is a Contracting Engineer, care U. S. S. P. Co., 30 Church St., New York City.



'00. M. E. Shire will be located after March 1, 1919, with the A. G. Becker & Co., Commercial Paper and Bankers, 137 S. LaSalle St., Chicago, Ill.

'01. W. C. Affeld of 2725 Colfax Ave. So., Minneapolis, Minn., is Manager of the Minneapolis Plant of the Albert Dickinson Co. His office is at 107 Chamber of Commerce.

'01. Alexander F. Armstrong resides at 19 S. Hawk St., Albany, N. Y. He is Civil Engineer and Business Representative for the Atlantic Refining Co., of Philadelphia, Pa.

'01. Meier George Hilpert is an Assistant Engineer for the Bethlehem Steel Bridge Corporation at Bethlehem, Pa. His home address is 211 Briggs St., Harrisburg, Pa.

'01. Alfred S. Mirick is located at 1421 "G" St., Lincoln, Neb., as Chief Road Engineer of the Highway Dept. His business address is Office of State Engineer, Lincoln, Neb.

'01. Stuart Purcell, Captain, Quartermaster Department, U. S. A., has been appointed Division Engineer of Highways under G. F. Weighardt, '09, City Highways Engineer of Baltimore.

'01. Nelson O. Tiffany is now President and General Manager of the Masonic Life Association, Masonic Temple, Buffalo, New York. He resides at 214 W. Ferry St., Buffalo, New York.

'02. Lloyd C. Gage, of 1231 W. Broadway, Butte, Mont., is a Civil and Mining Engineer with the Anaconda Mining Co. He spent last winter at the Cerro Verde Mine near Arequipa, Peru, with the Andes Exploration Co.

'02. Chas. H. Snyder is Assistant City Engineer, City Hall, Oswego, N. Y. He resides at 170 West 4th St., Oswego, N. Y.

'03. Joseph E. Craig of 1449 Third Ave., Columbus, O., is Hydraulic and Electrical Engineer for Lockwood, Green & Co., engineers for Camp Gordon and Camp Johnston.

'03. Frederick W. Fisher is with the Rochester Railway and Light Co., at 34 Clinton Ave., N. Rochester, N. Y., as Employment and Safety Manager. His home address is Fairport, N. Y.

'03. J. Wyman Ludlow is Harbor Engineer for the city of Los Angeles, located at City Hall, San Pedro, Cal. His home is at 552 Twelfth St., San Pedro, Cal.

'03. Arthur S. Whitbeck is Assistant Engineer in charge of the construction of the Barge Canal and the harbor at Rochester. His address is 160 Rockingham St., Rochester, N. Y.

'04. Frank H. Masters, Assistant Chief Engineer of the Elgin, Joliet and Eastern Railroad, Joliet, Illinois, has moved to 207 Youngs Ave., Joliet, Illinois.

'04. Carl R. Weidner of 306 W. Main St., Independence, Kan., is Chief Engineer for the Prairie Pipe Line Co.

'05. Don E. Andrews, whose home address is 330 Main St., South Bend, Ind., is now a technical expert in rubber production for the U.S. Rubber Co., at Kisaran Asahan, Sumatra, after being employed by the Mexican Rubber Co. in Mexico, and the Cargo Rubber Co., in Tropical Africa.

'05. John A. Baum recently honorably discharged as a Captain of the U. S. Engineers is now Assistant Engineer for the Penn. Lines, West, with offices at 1013 Penn. Ave., Pittsburgh, Pa. He resides at 42 Steuben St., Crafton, Pa.

'05. John E. Elliot is Plant Engineer for the American Bridge Co., at Trenton. His home is at 1530 Riverside Drive, Trenton, N. J.

'05. W. G. Harger of 16 Hinsdale St., Rochester, N. Y., is a Resident Engineer at Lima, O.

'05. E. W. Kramer of Missoula, Mont., is Hydro-Electrical Engineer for the U. S. Forest Service.

'05. H. V. Owens is Secretary and Treasurer of the Dale Engineering Co., General Contractors, Utica, N. Y. He resides at 127 Thomas St., Utica, N. Y.

'05. Henry G. Throop, 2117 S. Geddes St., Syracuse, N. Y., is Engineer of Way and Structures, New York State Railways, Syracuse.

'06. Alfred J. Edge is with the United States Rubber Plantation at Kisaran, Asahan, Sumatra, Dutch East Indies.

'06. C. S. Rindsfoos is Secretary and Treasurer of the Jarret-Chambers Co., Inc., 30 East 42d St., New York City. His home is at 100 Bellevue Ave., Upper Montclair, N. J.

'06. H. W. Rutherford is a civil engineer with a private practice at Seattle, Wash. He resides at 1021 Pine St., Seattle, Washington.

'06. Henry Ryon is a 1st Lieutenant, Q. M. C., stationed at Camp Bowie as Officer in charge of Water and Sewers. His home address is 626 Flatbush Ave., Brooklyn, N. Y.

'07. Harold A. Brainerd of 3905 Hawthorne Ave., Baltimore, Md. is an engineer for the American Bridge Co., 600 Continental Building of the same city.

'07. W. F. Faustman is Resident Engineer for the Calif. State Highway Commission. He lives at 423 22d St., Sacramento, Cal.

'07. F. W. Madigan of Lyons, N. Y., is Assistant Engineer, Dept. State Engr. and Surveyor.

'07. G. H. Rekate of Lancaster, N. Y., is at present on leave of absence from the Bureau of Lands, Philippine Islands, but does not expect to return.

'07. Louis J. Sieling, 211 Broad St., Red Bank, N. J., is an engineering contractor at 1270 Broadway, New York City. He has opened a branch office at 416 Commonwealth Bldg., Trenton, N. J.

'07. C. C. Sprigg is President of the General Contracting and Engineering Co., 29 Broadway, New York City. He resides at 15 Central Ave., St. George, Staten Island, New York.

'07. C. G. Wigley, 81 Saratoga Ave., Yonkers, N. Y., is Supervising Engineer for the Wallace and Tiernan Co., 349 Broadway, New York City.

'08. Robert D. Bogart is raising shorthorns at Prairie Grove, Ark., R. F. D. No. 2.

'08. Meyer Davis may be reached at the Hotel Plaza, San Francisco, Calif. He is Pacific Coast Manager for the Aspromet Company with offices at 1007 Hobart Bldg., San Francisco, Calif.

'08. Guy Hildebrand Hunt, who is an Instructor of Mechanics in the Case School of Applied Science, is now residing at 13512 4th Ave., East Cleveland, Ohio.

'08. W. Ernst Japhet is Chief Engineer for the Refining Department of the Humble Oil and Refining Co. His home address is 2600 Hopkins St., Houston, Texas.

'08. Clarence T. Seipp is Secretary-Treasurer for the Mueller Construction Co., General Contractors at Chicago, Ill.

'08. C. O. Ullrich is Expert Appraiser and Assistant Deputy Commissioner of the Bureau of Special Franchises, State Tax Dept., Capitol Bldg., Albany, N. Y. He resides at 6 Federal St., Albany, N. Y.

'09. Arthur W. Engel may be reached at 333 Thorn St., Sewickley, Pa. He is Estimating and Designing Engineer for the American Bridge Co., Pittsburgh, Pa.

'09. Walton Gibb of 4650 Locust St., Philadelphia, Pa., is Production Manager and Vice-President of Alexander Bros., Philadelphia, Pa.

'09. C. J. Kehrhan is Assistant Engineer for the Department of Grade Crossing Elimination, of the N. Y., C. and St. L. R. R. Co. His home address is 13600 4th Ave., East Cleveland, Ohio.

'09. H. G. Lanahan gives Laurel, Md., as his permanent address. At present he is Superintendent of Construction with the Hurley Mason Co., 500 Equitable Bldg., Tacoma, Wash.

'09. William F. Leschen is now residing at 6409 Enright Street, St. Louis, Mo. He is engaged in the oil and chemical business at 601 Bank Commerce Bldg., St. Louis, Mo.

'10. Milton W. Brower of 18 East Dayton St., Ridgewood, N. J., is with the Electric Bond and Share Co., 71 Broadway, New York City. His permanent address is his old home, Spencerport, N. Y.

'10. Herbert H. Conway is Supt. of Construction at Houston, Tex., for the Hedrick Construction Co. At present he is engaged on the erection of a \$750,000 oil refinery. His residence is Lansdowne, Pa.

'10. Major Walter L. Conwell, Assistant Professor of Highway Engineering was last heard from at the Combat Officers' Depot, A. P. O. 703, France, where he awaits orders which he hopes will be for home.

'10. Gerardus Harrison is a consulting engineer, located at 103 Park Avenue, New York City. His home is at the Larchmont Gardens, Larchmont, N. Y.

'10. E. F. Hettrick has been honorably discharged as Captain in the U. S. Army, Construction Division. He is now located at 2848 Highland Ave., Birmingham, Ala., with the E. F. Hettrick Engineering Co.

'10. Herman D. Hirsch is now Assistant Engineer for the American Bridge Company at 30 Church St., New York City. His home address is 1462 Park Place, Brooklyn, N. Y.

'10. Amos O. Nisenson is a Civil Engineer and Surveyor with offices at 9-15 Clinton St., Newark, N. J. He resides at 5 Hillside Ave., Newark.

'10. Horace Brady Robinson, Jr., resides at 1204 Crawford St., Houston, Texas. He is an engineer with The Texas Pipe Line Co.

'11. Andrew L. Ackhart lives at 502 Best St., Buffalo, N. Y. He is an engineer for the Eastern Concrete Steel Co., 402 D. S. Morgan Bldg., Buffalo, N. Y.

'11. Albert L. Goff is Drainage Engineer for Elba, N. Y.

'11. C. N. Scagrave of Gooding, Ida., is Manager of the Prest-O-Lite Battery Service Station for that town.

'11. G. Schirmer of 568 Arlington Pl., Chicago, Ill., is Sales Engineer for the Whiting Foundry Co., of Harvey, Ill.

'12. George W. Case a Professor of Sanitary and Hydraulic Engineering at the University of Pittsburgh is also Assistant Engineer for the

Morris Knowles, Inc. His home address is 3142 Avalon St., Pittsburgh, Pa.

'12. Albert Clunan, Jr., is Assistant Manager of Purchases for the J. G. White Engineering Corporation, 43 Exchange Place, New York City. Mr. Clunan is particularly interested in export work. He resides at 265 Ocean Ave., Brooklyn, New York.

'12. Max Grossman is Manager. of Grossman's Hotel of Atlantic City, N. J.

'12. Frank M. Gurney lives at 35 East St., Oneonta, N. Y. He is City Engineer for Oneonta with offices in the City Hall.

'12. Morris L. Kaufman of 918 Eastern Parkway, Brooklyn, New York, is a member of the Kaufman and Levine firm of Consulting and Industrial Engineers at 21 E. 40th Street, New York City. He was Engineer of the Cotton Purification Area on Government Explosive Plant "C" at Nitro, West Virginia.

'12. Harold J. Levine who was a member of the 41st Regt. C. A. C., is now Consulting and Industrial Engineer for Kaufman and Levine, 21 East 40th St., New York City. He is residing at 140 East 92d St., New York City.

'13. Joseph S. Harris is an engineer with the Public Service Commission for the First District of New York. His residence is 1037 Bryant Ave., New York City.

'13. Paul J. Maxon is an Engineer with the National City Bank of N. Y., 55 Wall St. He resides at 50 Palisade Ave., Bogota, N. J.

'13. Granbery Miller, Treasurer of the Drummond Miller Co., Builders, at Cleveland, may be reached at the University Club, Cleveland, Ohio.

'13. F. Barnard O'Connor of 1 Lexington Ave., New York City, is Assistant Engineer and Director of the Alphons Custodis Chimney Const., Co., 95 Nassau St., New York City.

'13. A. L. Stevenson is with the Emergency Fleet Corporation at Philadelphia, Pa., as Structural Engineer. He resides at 4910 Arch St., Philadelphia, Pa.

'14. Willis H. Hanchett is permanently located at 140 North 6th Ave., Nashville, Tenn. He has been on Maint. of Way Work for the Nashville, Chattanooga & St. Louis R. R. for over a year.

'14. Albert R. Reilly, Designer, E. F. C. Extension, N. Y. Ship-building Corporation, Camden, N. J., is now Production Manager of Plant. He is an Assoc. Member Am. Soc. C. E. and gives as his per-



manent address, 136 Park Ave., Watertown, N. Y. His temporary address is Box 172, Wenonah, N. J. He reports that G. F. Healy, '15, is a 1st Lieutenant and is now enjoying Paris, etc.

'14. E. T. Rummele is with the Beals Ship Building Co. of Port Jefferson, Long Island, N. Y. He may be addressed at Box 673, Port Jefferson, L. I.

'14. Christian Schwartz of 2961 West Grand Blvd., Detroit, Mich., is with the Accounting Dept. of the Studebaker Corp. of Detroit, after being in the Chemical Service of the U. S.

'14. Benjamin L. Smith, residing at 1705 Tenth St., Baltimore, Md., is an engineer with the Norton, Bird and Whitman, Consulting Engineers. He also reports that G. J. Requardt, '09, and T. W. Hacker, '16, are associated with the same firm.

'14. A. K. Webster is an Assistant Engineer in the Bridge Department of the Illinois Central R. R. Co., with offices at the Central Station, Chicago, Room 1000. His home address is 5548 Blackstone Ave., Chicago.

'14. Victor H. Werner is employed in the New York Sales Office of the Belmont Iron Works, 32 Broadway, New York City. He resides at 182 Sunnyside Ave., Brooklyn, N. Y.

'15. W. Donald Clark is located at 2d Ave. and Longworth St., Hazelwood Sta., Pa., care The Koppers Co. He is Assistant Engineer and Superintendent, and has just completed the building of the town of Melcroft, Pa. This is a town of 500 inhabitants and was built from the ground up, including a R. R. Power House, two Coal Mines and Mining Plant. At present he is located at the first address on the construction of a Byproduct Coke Oven.

'15. L. H. Edwards is Chief of Corps, Maintenance of Way Department, of the Erie R. R. His address is 630 Baldwin St., Meadville, Pa.

'16. A. F. Bacharach lives at 425 W. 22d St., New York City. He is a transitman with the Lehigh Valley Railroad attached to the office of Division Engineer at Jersey City. He reports that C. R. Adelson, '15, was recently married and is now with the French Commission at Washington, D. C.

'16. C. W. Middleton, Boilermaker and Oil-burning Engineer for the Babcock and Wilcox Co., has been running tests on the trial trips of new ships. He is living at 315 Clinton Ave., Brooklyn, N. Y. He adds that Charles Lahr, '15, is with the Public Service Commission as Outside Supervising Engineer on tunnel work.

'16. John L. Ober is an engineer for the Carson Construction Co. of Savannah, Ga., and is specializing in reinforced concrete construction. His home address is 138 Caroline Ave., Solvay, N. Y.

'16. Grover E. Rickard of 136 Stratford Ave., Pittsburgh, Pa., is a draftsman and chemist for Chester and Fleming, Consulting Engineers, Union Bank Bldg., Pittsburgh, Pa.

'16. N. T. Wood of 316 Clifton Pl., Brooklyn, N. Y., is with the American Telephone & Telegraph Co.

'17. William Addams, Jr., Lieutenant Coast Artillery, U. S. A., has recently received his honorable discharge. He is now engaged in the grain business at Cynthiana, Ky.

'17. Jacob Fuchs is Supervisor and Inspector of Reinforced Concrete for the Truscon Steel Co., 110 W. 40th St., New York City. His residence is 334 E. 17th St., New York City.

'17. Harry H. Hemmings of 639 East Third St., Brooklyn, N. Y., is a technical assistant in the Research Department of the Curtis Engineering Corporation, Garden City, L. I., N. Y.

'17. Abelardo R. Iscaiano is Assistant Engineer for the New York Chicago and St. Louis R. R. at 512 Columbia Building, Cleveland, Ohio. He resides at 2710 East 55th Street of the same city. Mr. Iscaiano has recently been elected to membership in the American Association of Engineers and the Cleveland Engineering Society.

'17. John S. Krauss is in training to be an Engineer Officer of the United States Navy. At present he is Chief Machinist's Mate in the Navy. His home address is 974 St. Nicholas Ave., New York City.

'17. Samuel J. Leonard, a Captain of Engineers in the U. S. Regular Army, is stationed at Camp Baker, El Paso, Texas.

'17. G. E. Lund is with the Submarine Boat Corporation at Newark, N. J.

'17. J. K. Van Campen is Assistant Plant Engineer for the Camden Forge Co., Camden, N. J. His home address is 702 Collings Ave., West Collingswood, N. J.

'18. Juan M. Bertran is in the Field Engineer's office of the B. & O. R. R. He writes that C. H. Li, '18, is also in the office. Bertran lives at 1201 N. Caroline St., Baltimore, Md.

'18. Maxwell Kurcias of 801 Fifth St., New York City, is an Ensign, U. S. Navy, aboard U. S. S. Winding Gulf, and at present stationed at La Pollice, France.

## BOOK REVIEW

*"Location, Construction and Maintenance of Roads,"* by John M. Goodell. Reprinted from "Good Roads Year Book," 1917, D. Van Nostrand Co., New York City. Cloth 6" x 9"; pp. 207, illustrated; \$1.00 net. Reviewed by John Edwin Perry, Instructor, College of Civil Engineering, Cornell University.

In this book Mr. Goodell has written exclusively about country roads, describing very concisely the best prevalent practice in locating, constructing, and maintaining rural highways. The data has been collected from many different parts of the United States, and to make the book general in its scope, many of the chapters were submitted to and revised by some of the leading national highway authorities.

The first few chapters of the book describe the general principles of good road location, the establishment of grades, the securing of proper drainage, and the essential features of good culvert, bridge, and ford construction. The regulations of the California Highway Commission regarding surveys and plans are submitted as an exemplary chapter on this phase of the subject. Earth, sand-clay, gravel, and water-bound macadam roads are taken up in succession. The modern methods of constructing brick highways are outlined in two chapters. The chapter on concrete road building is a summarization of the reports submitted at the Second National Conference on Concrete Road Building. "The report of this conference," the author tells us, "exercised a standardizing influence on methods of construction." The book gives very interesting and important information regarding the sources, uses, selection, and application of bituminous materials in country road construction, and tables are introduced giving for comparison the bituminous specification requirements of many state highway departments. There is a chapter devoted to the subject of highway bonds with tables added, to aid in bond problem computations, the subject of road resistance to traction is also discussed in a short chapter.

The valuable and up-to-date information found in this book should make it very useful to the highway engineer and to all who are interested in better roads.



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# THE CORNELL CIVIL ENGINEER

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## ECONOMICAL SIZE OF PIPE FOR GIVEN LOSS OF HEAD

E. W. Rettger, Ph.D.

The most economical size of penstock is a matter of the greatest importance when the penstock is a long pipe under high head. In such a case the first cost of the penstock is apt to be the largest part of the total first cost of the plant and it is therefore very important that the most economical size of the penstock be determined.

Before the most economical size of penstock can be determined, it is necessary to know what principle of economy is to be used. This principle may be different for different plants. For instance, it may be required to determine the size of the pipe so that the total net annual income shall be a maximum, or so that the percentage return on the original investment shall be a maximum. In other cases it may be required to determine the pipe so that the percentage return on the original investment shall be a specified amount. This may be the case when the amount of water available is limited and when it is imperative to produce as much power as possible, consistent with a fair rate of return on the original investment. Thus, the economic design of a penstock may come up in a variety of forms.

When the penstock is to consist of a pipe of constant diameter throughout, the problem, so far as the penstock is concerned, is comparatively simple. Assume, for instance, that the net annual income shall be a maximum. A simple and direct method of procedure in determining the economical size of pipe of constant diameter throughout, under the given principle of economy, is as follows:

Calculate or approximate the total net annual income for each of several assumed diameters. With the diameters as abscissae and the total net annual income as ordinates, a curve may be plotted. From

this curve, the diameter can be found for which the total net annual income will be a maximum.

In the case of high heads, however, it is often found economical to make the pipe consist of two or more sections of different diameters. Such a pipe would approximate the shape of a funnel with the smallest diameter where the head is the highest. In other cases it is found economical to make the upper part—the part under the low head—consist of concrete or staves and the remainder of steel. The determination of the economical pipe now reduces to the determination of the diameters of the several sections and the problem may not be an easy one. The method of procedure suggested for the case of a pipe of constant diameter throughout, is no longer applicable. While considerable latitude is left to the designer it is nevertheless important to be able to determine what the theoretically economical diameters of the several sections are.

In 1907, A. L. Adams proposed a principle for the design of a penstock that seemed to him self-evident. This principle may be stated as follows:

*That pipe is most economically designed for which the interest and depreciation on first cost of the pipe plus the annual value of the power lost due to friction in the pipe is a minimum.*

This principle of economy seems simple and logical and it is referred to in nearly every discussion on the economical size of penstock. Frequently, formulas for the economical diameter are derived from it. For the case of riveted steel, Professor D. W. Mead (Mead's Water Power Engineering, 2d edition, page 546) derives two formulas:

$$(1) \quad d = 0.2153 \sqrt[7]{\frac{f l q^3 S}{c i h}} \quad \text{for high head}$$

and

$$(2) \quad d = 0.2195 \sqrt[6]{\frac{f l q^3}{t' c i}} \quad \text{for low head}$$

where  $h$  is the head on the point under consideration;  $f$  is the coefficient of friction defined in equation (3) which follows;  $S$  is the allowable unit stress in shell in pounds per square inch corrected for rivet holes and water hammer;  $c$  is the cost of the metal per pound;  $i$  is the rate of interest and depreciation on first cost of pipe;  $b$  is the annual value of a horsepower at the wheel; and  $q$  is the discharge in cubic feet per second.

When the required theoretical thickness of the shell is more than the minimum allowable thickness, the pipe is considered to be designed for high head and formula (1) applies. When the theoretical thickness

of the shell becomes less than the minimum allowable thickness, formula (2) applies, which was derived on the assumption that the thickness of the shell shall be the minimum allowable thickness,  $t'$ .

From formula (1) it is seen that the theoretically economical diameter of a pipe under high head decreases as the head,  $h$ , increases; and from (2) it is seen that the economical diameter for a pipe under low head is independent of  $h$ .

In deriving formulas (1) and (2) the friction head was assumed to be given by,

$$(3) \quad h' = \frac{fl}{d} \cdot \frac{v_2^2}{2g}.$$

Now  $f$  is unknown to start with since it depends upon the diameter of the pipe which is not yet determined. In practice, a value of  $f$  is first assumed, and the diameters of the pipe are determined by means of the above formulas. If the average value of  $f$  for the pipe so determined differs appreciably from that assumed, a revised value for  $f$  is taken.

If the friction head for riveted steel pipes is assumed to be given by the formula:

$$(4) \quad h = 0.00050 \frac{v^2 l}{d^{1.25}};$$

the resulting formulas become:

$$(5) \quad d = 0.1423 \sqrt[7.25]{\frac{bq^3S}{cih}} \text{ for high head;}$$

and

$$(6) \quad d = 0.1356 \sqrt[6.25]{\frac{bq^3}{t'ci}} \text{ for low head.}$$

Formulas (5) and (6) do not contain the unknown coefficient  $f$ . So far as the writer knows, formulas (5) and (6) are here given for the first time.

If the value of  $b$ , the value of a hydraulic horsepower at the wheel, is given, Adams' principle and the resulting formulas will solve the problem. Unfortunately the proper value for  $b$  is not always known. As already stated the principle of economy to be used in the design of a penstock may be one of several, and Adams' principle may be difficult to apply. Engineers of experience declare that this principle is not always applicable. These considerations urged the writer to see if a method of attack analogous to that suggested for a pipe of constant diameter throughout could be used, and as a result he has arrived at certain conclusions that may be of interest to students of hydraulics.

MOST ECONOMICAL PIPE FOR A GIVEN TOTAL LOSS OF HEAD DUE TO  
FRICTION IN THE PIPE

If for an assumed total loss of head,  $h'$ , the most economical pipe could be found, the following method would be applicable. For each of several assumed values for the total loss of head,  $h'$ , in the pipe, determine the economical pipe, and if, the total percentage return,  $p$ , is to be a specified amount, calculate or approximate the *percentage return* for each assumed value of  $h'$ . A curve can then be drawn with  $h'$  as the abscissa and  $p$  as the ordinate. From this curve the value of  $h'$  can be obtained so that the percentage return shall be the desired amount. Now with  $h'$  determined, the most economical pipe can be found.

If the pipe is homogeneous—made entirely of riveted steel for instance—the pipe of least annual cost will be the pipe of least first cost, or of least amount of metal. If the pipe is not homogeneous, such as when the upper part is of staves and the lower part of steel, it is no longer a question of least amount of metal but rather one of least first cost or least annual cost. As shown later, the expression that will determine the diameter of the pipe for least annual cost will also determine the pipe for least first cost or least amount of metal (pipe homogeneous) if one or two of the constants involved are made equal to unity. It will be convenient therefore, to consider the case of least annual cost. The problem may be stated as follows:

*Given a pipe of fixed length,  $l$ , and under a given head,  $h$ , with a given discharge,  $q$ , it is required to find the size of the pipe so that for a given or assumed total loss of head,  $h'$ , in the pipe the annual cost of the pipe will be a minimum.*

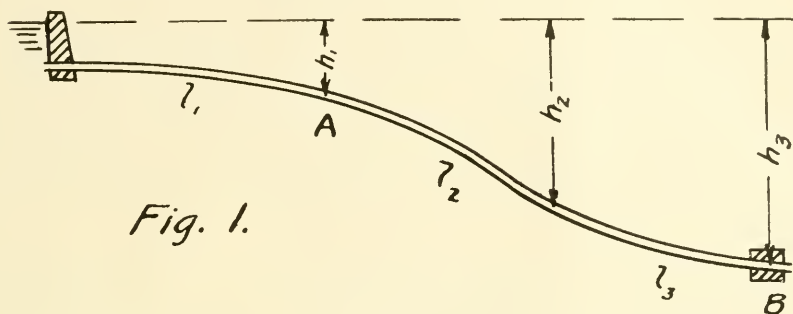
The problem as thus stated is of considerable interest. In the *Engineering Record* of December 20, 1913, page 682, E. R. Bowen describes the inverted Jawbone Syphon of the Los Angeles aqueduct. This inverted syphon was to be designed to contain the least amount of metal subject to the condition that the loss of head due to friction in the syphon should be 26 feet. The solution as given by Mr. Bowen is a graphical one requiring a great deal of labor. This same problem could have been solved in a much simpler way.

The annual cost of the pipe is the interest and depreciation on first cost and this will be represented by  $I$ . The problem then is to find the size of the pipe so that  $I$  will be a minimum, subject to the condition that the total loss of head in the pipe shall equal  $h'$ .

■ In practice, the pipe is made to consist of two or more sections, each section of constant diameter and thickness of shell. The greater number of sections, the more nearly will this pipe approach the theoretically

most economical pipe, one in which the diameter decreases as the head increases.

For the sake of convenience we will assume that the pipe is to consist of three sections as shown in Figure 1.



Let  $l_1, h_1, d_1$ ;  $l_2, h_2, d_2$  and  $l_3, h_3, d_3$  be the lengths, heads and diameters of the respective sections.

Evidently, the location of the points of division  $a$  and  $b$  will effect the economy. It can be shown that the location of the most economical points of division depends upon the profile. These points, perhaps, can best be found by trial. For our purpose it is necessary to assume that the points of division are given. Consequently  $h_1$  and  $l_1$ ,  $h_2$  and  $l_2$ ,  $h_3$  and  $l_3$  are assumed as given or determinate.

The interest and depreciation on first cost of a section is proportional to the amount of metal in that section. Using a well known principle of hydraulics the amount of metal in that section under high head is found to be proportional to  $d_r^2 h_r l_r$ . The subscript  $r$  is used to indicate that it applies to a section and not to the pipe as a whole. The annual cost (interest and depreciation) of this section may therefore be represented by the equation

$$(7) \quad I_r = A d_r^2 h_r l_r;$$

where  $A$  is a constant. Moreover, the friction head for this section may be expressed by (see eq. 3)

$$h'_r = \frac{f l_r}{d_r} \cdot \frac{v_r^2}{2g}$$

or, if  $v$  is eliminated by means of the relation  $F_r v_r = \frac{1}{4} \pi d_r^2 v_r = q$ , by

$$(8) \quad h'_r = \frac{C l_r}{d_r^5};$$



where  $C$  is a constant. The problem then requires us to find  $d_1$ ,  $d_2$ , and  $d_3$  so that

$$(9) \quad I = I_1 + I_2 + I_3 = A (d_1^2 h_1 l_1 + d_2^2 h_2 l_2 + d_3^2 h_3 l_3)$$

will be a minimum subject to the condition that

$$(10) \quad h' = h'_1 + h'_2 + h'_3 = C \left( \frac{l_1}{d_1^5} + \frac{l_2}{d_2^5} + \frac{l_3}{d_3^5} \right)$$

shall have a specified value. If, now,  $\lambda$  is a constant, the expression,

$$(11) \quad L = I + \lambda h',$$

will be a minimum when  $I$  is a minimum. Since  $h'$  shall have a definite value it may be considered a constant. Substituting the values of  $I$  and  $h'$  as given by equations (9) and (10) and rearranging, equation (11) becomes

$$(12) \quad L = (I_1 + \lambda h'_1) + (I_2 + \lambda h'_2) + (I_3 + \lambda h'_3) = L_1 + L_2 + L_3$$

For an assumed mode of division of the pipe into sections,  $h_r$  and  $l_r$  are given for each section and therefore must be considered as constants. Consequently  $L_1$  contains  $d_1$  as the first variable. Similarly,  $L_2$  contains  $d_2$  as a second variable and  $L_3$  contains  $d_3$  as the third variable.  $L_1$ ,  $L_2$ , and  $L_3$  contain no variable in common and they are therefore independent functions. From this it follows that if their sum must be a minimum, each separately must be a minimum. That is, we must have separately

$$(13) \quad \frac{d L_1}{d (d_1)} = 0 \quad \frac{d L_2}{d (d_2)} = 0 \quad \text{and} \quad \frac{d L_3}{d (d_3)} = 0$$

Or in general (see eq. (11),

$$(14) \quad \frac{d L_r}{d (d_r)} = \frac{d I_r}{d (d_r)} + \lambda \frac{d h'_r}{d (d_r)} = 0$$

for each section of the pipe.

Since  $\lambda$  is a constant, yet to be determined, we may arbitrarily let,

$$(15) \quad \lambda = \frac{b q}{8.8}$$

and consider  $b$  the constant yet to be determined. Substituting in equation (14), we obtain,

$$(16) \quad \frac{d L_r}{d (d_r)} = \frac{d I_r}{d (d_r)} + \frac{b q}{8.8} \cdot \frac{d h'_r}{d (d_r)} = 0$$

for each section of the pipe.

From equations (7) and (8), it is seen that  $l_r$  is a factor of equation (16). Dividing through by  $l_r$  and performing the differentiation indicated, the resulting equation becomes identical with that derived by Prof. Mead (Water Power Engineering, page 546). Formula (1) therefore, gives us the required diameter for any section under high

head and formula (2) for low head. The value of  $h$  to be used in formula (1) when applied to any section should be of course the highest head that section is under.

In the present interpretation of formulas (1) and (2)  $b$  is not to be considered as the value of a hydraulic horsepower at the wheel, but as a constant or parameter such that the total loss of head in the pipe shall be  $h'$ . Although a constant,  $b$  is not arbitrary, but its value must be determined. This can be done in the following way. For riveted steel pipes, the diameters as determined by formulas (1) and (2) must satisfy the equation, (see equation (10))

$$(17) \quad h' = C \left[ \frac{l_1}{d_1^5} + \frac{l_2}{d_2^5} + \frac{l_3}{d_3^5} + \dots \right]$$

If, therefore, the values of  $d_1$ ,  $d_2$  and  $d_3$  as given by formulas (1) and (2) be substituted in equation (17), the resulting equation will contain  $b$  as the only unknown, and therefore  $b$  is determined. If, for instance, the first section is under low head and the other two under high head,  $d_1$  is given by formula (2) and  $d_2$  and  $d_3$  by formula (1).

Instead of determining  $b$  algebraically as was suggested above, a value for  $b$  may be assumed and the diameters determined by means of the formulas. A few trials will suffice to determine  $b$  so that the total loss of head in the pipe line will be  $h'$ .

Since for a given mode of division of the pipe line into sections,  $h'$  is determined as soon as a value for  $b$  is assumed, the formulas (1) and (2) may be given a new interpretation. According to this interpretation  $b$  may be taken as a parameter such that for every assumed value for  $b$ , the resulting pipe line will, for the resulting total loss of head in the pipe, be the pipe of least annual cost (or least first cost or least amount of metal). This interpretation so far as the writer knows is here given for the first time.

In special cases  $b$  may be taken as the value of a hydraulic horsepower at the wheel. The new interpretation however still holds since the pipe as thus determined will be the most economical pipe for a particular loss of head. The new interpretation of formulas (1) and (2) (and all other formulas of the same nature) is therefore the general interpretation, and these formulas as an expression of Adams' Rule become a special case.

The economical size of a penstock or pipe may now be determined in a manner analogous to that suggested for pipes of constant diameter throughout. If, for instance, the percentage return on the original investment shall be a specified amount, we may proceed as follows:

For each of several assumed values for  $b$  determine the pipe and calculate or approximate the percentage return  $p$ . With  $b$  as abscissa and  $p$  as ordinate a curve may be drawn. From this curve that value for  $b$  may be obtained for which the percentage return is the specified amount.

#### ILLUSTRATIVE PROBLEM

A hydro-electric plant is to be designed so that the gross percentage return on original investment shall be a specified amount. The pipe is to be riveted steel. Besides the data given in the figure let,  $q = 50$  cu. ft. / sec.

$$S = 10,000 \text{ lbs. / sq. in.}$$

$$t' = \frac{1}{4}'' \text{ as a minimum value,}$$

$$c = \$ .05$$

$$i = \$ .12$$

Since the pipe is homogeneous, the pipe of least annual cost is also the pipe of least amount of metal. We may if we choose, let  $c = i =$  unity (or we may let  $\frac{b}{ci}$  be the constant) and design for minimum amount of metal. The final results will not be affected. We will design therefore for least annual cost..

As a first trial let  $b = 50$ .

To eliminate the unknown coefficient of friction  $f$ , use formulas (5) and (6). From (6)

$$d_1 = 0.1356 \sqrt[6.25]{\frac{b q^3}{t' c i}} = 4.35 \text{ ft.}$$

Run this section (low head) down to  $h_1 = 220$  ft.

Divide the rest of the pipe line into three sections as indicated in figure. From (5)

$$d_2 = 0.1423 \sqrt[7.25]{\frac{b q^3 S}{c i h_2}} = 3.70 \text{ ft.}$$

$$d_3 = 3.50 \text{ ft.}$$

$$d_4 = 3.35 \text{ ft.}$$

For the pipe thus determined, the total investment may be calculated, and the total annual income approximated. If the percentage return is the amount specified the problem is solved. If not, another trial value for  $b$  should be shown. In fact several trial values for  $b$  may be successively chosen and a curve drawn with  $b$  as abscissa and  $p$ , the percentage return as ordinate. From this curve the proper value for  $b$  can be found.

With the diameters of the four sections as determined above, the total loss of head in the pipe line is found to be  $h' = 49$  ft. The above pipe then for  $h' = 49$  ft., and for the particular mode of division assumed, is the most economical pipe that can be constructed.

It may be of interest to add the following. If the above pipe of four sections had been designed for a constant diameter throughout

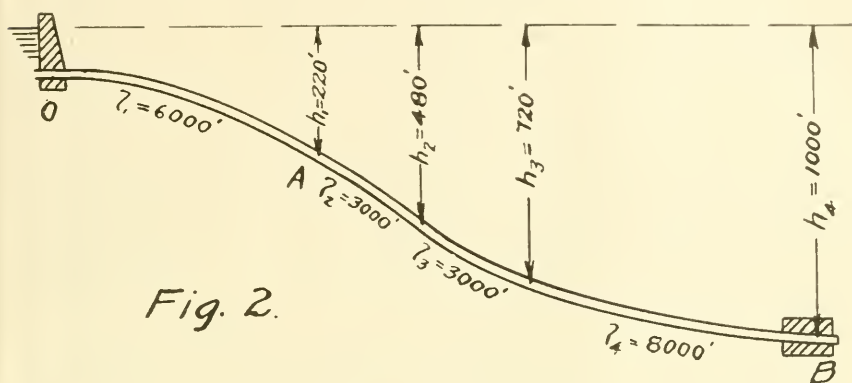


Fig. 2.

but variable thickness of shell, this pipe for  $h' = 49$  ft., would require 3.5 per cent more metal. If the part AB, the part under high head and consisting of three sections had been designed for a constant diameter throughout but variable thickness of shell, only .8 per cent additional metal would be required. It seems advisable therefore to make the part AB have the same diameter throughout but to change the thickness of shell several times.

If the pipe had been considerably larger, the last statement would not hold. In such a case the saving in the amount of metal required if the pipe under high head is designed for several sections of different diameters and thickness of shell over that required if these sections are designed for the same diameter but different thicknesses of shell may be appreciable. In many cases, however, this saving is not enough to justify the expense of reducers.

The question therefore arises: What is the formula for a pipe or part of a pipe that shall consist of a certain number of sections all of the same diameter but different thicknesses of shell? This question can be readily answered. Referring to Fig. 1, assume that the three sections shall have the same diameter but different thicknesses of shell. Then (see equations (11), (9), (10), and (15))

$$L = Ad^2 (h_1 l_1 + h_2 l_2 + h_3 l_3) + \frac{bq C}{8.8 d^5} (l_1 + l_2 + l_3)$$

This must be a minimum. That is,

$$\frac{d}{d} \frac{L}{(d)} = 2Ad (h_1 l_1 + h_2 l_2 + h_3 l_3) - \frac{5}{8.8} \frac{bq}{d^6} C (l_1 + l_2 + l_3) = 0$$

Now let

$$(18) \quad h_c = \frac{h_1 l_1 + h_2 l_2 + h_3 l_3}{l_1 + l_2 + l_3}$$

and solve for  $d$ , and we obtain, for high head,

$$(19) \quad d = 0.2153 \sqrt[7]{\frac{fbq^3 S}{c i h_c}}$$

as the required diameter of a pipe (or part of a pipe) that shall have the same diameter throughout but shall consist of a given number of sections of different thicknesses of shell. Formula (19) is the same as formula (1) except that  $h$  of (1) must be replaced by  $h_c$  as defined by (18). So far as the writer knows formula (19) is here given for the first time.

Suppose that the part  $AB$  of the problem given above shall consist of three sections as shown and that these sections shall have the same diameters but different thicknesses of shell. From (18)

$$h_c = \frac{(3000 \times 480) + (3000 \times 720) + (8000 \times 1000)}{3000 + 3000 + 8000} = 828 \text{ ft.}$$

Formula (1) or (5) may now be used if  $h$  is taken as 828 ft., and the resulting value for  $d$  will be the economical diameter of the part  $AB$  consisting of three sections of the same diameter but of different thicknesses of shell.



## A TRIP ACROSS THE ANDES

Extract from Letter from Albert Diamant, C. E. '09

My trip from Uruguay to Tocopilla was an interesting one. I left Paysandú on an evening train which suffered a derailment before reaching Montevideo. I stayed at the capitol but two days during which time I squeezed in a dinner with Alan Towers, E.E. '09, and from there an all night boat ride brought me to Buenos Ayres. My plans were to spend three days in the Argentinian metropolis, hoping that by that time the nation wide railway strike, which had been on for three weeks, would be over. But things grew from bad to worse, and I could not leave the city till after a sixteen day delay.

At that time Buenos Ayres was very interesting. It was the time shortly after the exposure by Lansing of the Luxburg correspondence and all of South America, with the possible exception of pro-German Chile, was in an uproar. There was not a bit of plate glass left to adorn the front of a single German store. The German club was burned to cinders, naught but the four stone walls remaining. The embassy was guarded, and "La Razon," a pro-German paper was completely blocked off by mounted police. The streets were littered with handbills, most of them pro-ally, and the remaining ones not pro-German but pro-neutral. All kinds of parades and meetings were held, all carefully surrounded by police and soldiers.

I left Buenos Ayres on the first train out, thanks to a small bribe I was able to get sleeper accomodations. Our train, which was the longest passenger train ever to make the trip was preceded by a pilot engine, and we arrived at Mendoza, the foot of the Andes twelve hours late. This Central Argentinian railway has a tangent 173 miles long, at the end of which is a small curve followed by another tangent forty-three miles in length. The soil along the line is very fertile, but due to lack of rain lies absolutely waste. The few spots which are irrigated look very pleasant and prosperous. Here is a chance for a big irrigation project if capital could be interested. Throughout the entire length of almost two thousand kilometers, not a city is to be found—and we ran across only one auto—a Ford.

We crossed the Andes, in one day on a narrow gauge track with a third geared rail to help along on the steep grades—some as high as eight per cent. On these grades you could step off the car and outwalk the train. It is a wonderful piece of location work. The line follows a river on the Argentinian side, tunnels under the divide, and then follows another river on the Chilean side. The highest point along the line is at elevation 10,500 feet. The mountains of course are bare, except at

the higher altitudes, where snow lies all the year round. The line is open for traffic throughout the year, except for a few days now and then when the snowfall is too heavy.

The narrow gauge line ends at Llai-Llai, from which a full gauge line with good American rolling stock takes you to Valparaiso in four hours.

I was disappointed in Valparaiso. The location is pretty but the city is extremely ugly. After a three day wait I took a steamer to Antofagasta, stopping on the way at Coquimbo. None of these western cities has a good harbor, much less good dock facilities. Everything is lightered. On a rough day it is impossible to land at the docks. This boat trip took over three days, and once at Antofagasta I had choice of waiting five days for a boat to Tocopilla, or three days for a train. By this time I was weary of all these delays, and I took the first chance that presented to reach my destination. I am glad I took the train trip but I shall never do it again. We left on the Antofagasta-Bolivian railway at three one afternoon, and at nine that evening we changed over to another line—the Longitudinal R. R. Both are narrow gauge lines, and I had my so-called night's rest in an upper berth, right over the truck. A very wonderful combination—an upper berth on a narrow gauge line! We arrived at Toco at 4.00 A. M., where we were carted on a hand car to a so-called hotel to catch some sleep.

Toco is up on the pampa, in the midst of the nitrate fields. The train for Tocopilla was not due to leave till one in the afternoon, so I had time enough to look around. I started off for one of the nitrate plants, but so immense was the heat and so hard was the loose dirt on the feet, that after walking a few yards I turned back. I shall never want to go to a nitrate field again. I wonder how the people can stand it. After what seemed an endless wait, we finally started off and at the end of a three hours run reached Tocopilla. In other words, to get from Antofagasta to Tocopilla, which is an eight or nine hour run on a slowly moving coast steamer, I took a railway for the interior, ascended to a height of some 5700 feet, and came down again through a narrow gorge to the coast. I left Paysandú October second and landed at Tocopilla October thirtieth! A wonderful trip.

Here we have a power plant of four 10,000 K. W. units, 110,000 volts which transmits the power 143 kilometers to the company's mines at Chuquicamata. I came down as office engineer for the construction of a fifth unit, but, after a series of events too long to relate I was taken out of the office and put in charge of the construction of the foundations. Gradually I was put at the head of the entire plant installation, and a few months ago, in charge of all construction. The new plant is a steel frame structure 60 by 186 feet and some 100 feet high. In addition I

am looking after some railway work, the construction of a 60 feet by 60 feet reinforced concrete warehouse, and a condensing-water screen chamber at the water front. The warehouse will be completed this week and at the screen chamber all the concrete work—some 1600 cubic yards is done and we are now driving two tunnels—one for an intake from the sea, and the other to connect the new screen chamber with the old intake tunnel. While I am a wee bit scared of the tunnel work I have had fairly good fortune thus far. In about one more week we should break through.

As you know it is a long cry from sewer digging to power plant construction and it keeps me busy trying to appear wise on something which to me is entirely new. But now I can talk a wee bit about turbines, condensers, evaporators, all kinds of piping, etc.—just as though I really knew something about it. We have two hundred men working, and the total cost of the work will be some two million dollars. Some of our material is still on the docks at New York, and some of our plant is already in operation—without walls and without roof. We are here in a dry rainless country, and a superstructure is really a luxury. All our fresh water is condensed seawater, our evaporators turning out ten tons per hour. In fact, the only source of water supply in Tocopilla is evaporated sea water. That can give you some idea of the extent of the local scare when some months ago the States, for a time, shut off the export of oil for Chile. It meant, at least here in the northern part, the stopping of all industry and the elimination of drinking water.

Sawyer, 1914, is at the mine at Chuquicamata. I know no other Cornellians up here—oh yes, Ed Savage, 1900, I believe.

We are all glad of course that the war is over. All of us here registered for the draft and were placed in class 4A—employees in war industries. If our material arrives we should finish our work in March or April, and, after that I do not know what I shall do—whether stay here or go back to sewer digging. Of course I prefer the latter.

## OBITUARIES

Jay W. Toms, C. E., 1909

Jay William Toms died at his home in Frederick, Md., on December 20, 1918, of influenza.

He was born at Frederick on September 16, 1888. He prepared for college at Frederick High School, entering Cornell in 1905 and receiving the degree of C.E. in 1909. In college he was a member of Phi Kappa Sigma, Semaphore, and the Maryland Club, and was President of the Association of Civil Engineers in his senior year. He played on the C.E. baseball team in his senior year.

Following graduation, he was up to 1916, a reinforced concrete designer for the Corrugated Bar Company, located first in St. Louis, then in turn in their Buffalo, New York, New Orleans, and Chicago offices, except for about a year, when he was Estimator in the Atlanta office of the Industrial Engineering Company. He was elected a Junior Member of the American Society of Civil Engineers in 1909. In 1916, he formed a partnership with John Benedict, of Davenport, Ia., for the sale of building materials. In the fall of 1917 his health failed due to overwork, resulting in a severe case of pneumonia, and he never entirely recovered. In the spring of 1918 he went to Denver hoping to improve his condition. He was recalled in October by the death of his brother Keefer from influenza. Being appointed executor of his brother's estate, he postponed his return to Denver against his physician's advice. The eastern climate was too severe for him, and after contracting influenza, he lived only five days. Another brother, Lester, died on December 22, of influenza.

He is survived by one brother, Captain Raymond E. Toms, C.E. '07, who returned from France in January.

John Morgan Sill, C.E., 1911

Died January 22, 1919

John Morgan Sill died at Detroit, Michigan, January 22, 1919, of pneumonia.

Sill was born on August 19, 1887, and received his preparatory training at the Watertown High School, N. Y. After attending Colgate, he completed his training in three years at Cornell, and graduated with the degree of Civil Engineer in 1911.

For a few years after graduation he was connected with C. C. Hopkins, Consulting Engineer, at Rochester, N. Y., in the capacity of

Resident Engineer. In 1916 he became Superintendent of the Water and Light Department of Wellesville, N. Y., and in 1917 General Manager of the Castaluminum Body Co., at Detroit, Michigan. From 1918 to the time of his death on January 22, 1919, Sill was Service Station Superintendent for the Standard Oil Company at Detroit, Michigan.

**Winthrop Colt Fanning, C. E., Class of 1916**

Died March 10, 1919, at Chatillon-sur Seine, France.

Winthrop C. Fanning was born at Whitestone, N. Y., August 1, 1895. He took the regular Civil Engineering Course at Cornell, receiving the Degree of C. E. in 1916. After leaving Cornell he was in the employ of several construction companies in the Pittsburgh district.

He entered the Reserve Officers' Training Camp at Fort Niagara, May 12, 1917. As he was the youngest man in his company, he failed to obtain appointment as an engineer officer. He accepted an appointment in the aviation service and trained at the Cornell School of Military Aeronautics, Ithaca, N. Y., also as a pilot at Mineola, Lake Charles, Dallas, Fort Sill and Mt. Clemans, Fields. He received a commission of 2d Lieutenant at Lake Charles in March, 1917. On August 19, 1917, he married Emilye R. Lauver of Altoona, Pa.

Lieut. Fanning sailed from New York, Sept. 25, 1918, unattached, and took supplementary training at various fields in France, being attached in December, 1918, to the 168th Aero Squadron. He died of pneumonia, following influenza, March 10, 1919, at Chatillon-sur-Seine. He is survived by his wife and eight months old son, Winthrop Colt Fanning, Jr.

Fanning was an exceptionally fine type of student and man, and made many warm friends among faculty and students while at Cornell. During his last two years in college, he assisted Prof. Charles L. Crandall, on a good deal of practical engineering work, and won Professor Crandall's highest regard and friendship.



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## EDITORIALS

### Economical size of Penstock

The importance of the selection of the most economical size of long penstocks under high heads has led to the development of various methods of computation.

The basic principal of nearly every discussion has been the simple logic of A. L. Adams, that states, "That pipe is most economically designed for which the interest and depreciation on first cost of the pipe plus the annual value of the power lost due to friction in the pipe is a minimum." "Mead's Water Power Engineering" contains two formulas for the economical diameter of penstock, one for high and the other for low head, that are based on Adams' principle. Many engineers, however, have found that this apparent self evident basis of economy, is not applicable under conditions, where the pipe is of varying diameter throughout. A laborious graphical process was devised by E. R. Bowen to take account of the economical change of diameters, in the design of the inverted Syphon of the Los Angeles Aqueduct.

In the discussion on page 83, Professor Rettger puts a new interpretation on the formulas, derived by Professor Mead, that enables the determination of the economical size of penstock with varying diameters, in a manner analogous to the simple method used where the pipe is of constant diameter throughout.

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**Engineering** of the Engineering Colleges have laid great stress on  
**Education at** expressions such as, "The effect of the war will result  
**Cornell** in radical changes in the practice of all branches of  
engineering and educational methods of schools of  
engineering will therefore need modification and readaptation to conditions". Also, the consolidation might result in economy of equipment and cost of instruction. This solution of engineering education is as definite in probable results as the often seen solution of the labor problem that proposes to "bring capital and labor together in harmony".

It is quite true that there is room for improvement in the Engineering Colleges but from external appearances and results, the deficiency is of a financial nature rather than a flaw in administration and arrangement of courses.

If the proposed merger could in some way stimulate donations to the engineering colleges, and increase their income the consolidation would no doubt be an advantage. In considering the possible economy of the new plan, no mention has been made as to whether the money that might be saved, would be devoted to expenditures in the engineering colleges, or whether their apportionments would be cut down in proportion to the saving.

In an extensive report of a committee of the Board of Trustees a few years ago, it was shown that both Sibley College and the College of Civil Engineering were among the lowest in cost of instruction. This is not surprising when a comparison is made between the number of full professorships in other colleges of the University and the number in the engineering colleges. In spite of this the tuition for engineering courses is higher than in the other branches of education.

It can not be said that the deterioration and lack of equipment of the Hydraulic Laboratory, which has one of the best sites in the country for experimental work, has been due to a lack of efficiency in engineering education and the absence of a centralized administration of the engineering colleges. The most theoretically efficient organization possible can not administer efficiently without sufficient funds.

The Colleges of Engineering do not need radical changes in courses and administration, they need dollars.



## COLLEGE NOTES

### **Semi-Centennial Celebration**

The returns from the first call indicate that five thousand Cornell men and women, will be in Ithaca from June 20-23, to celebrate the greatest event in the history of the University, and to plan for still greater things for the future. The second call has gone out and the invitations have undoubtedly reached almost every alumnus. This is not the last call, for the call of the Alma Mater, the familiar faces, and a better and bigger University is everlasting.

As the following program indicates, it will be distinctly a Cornell affair, without the elaborate ceremonies, and delegates from institutions of Europe, that were to constitute the original plan.

### FRIDAY, JUNE 20

Morning: Formal Semi-Centennial addresses by President Schurman, Judge Hughes, Governor Smith and Judge Hiscock.

Noon: Reception by President and Mrs. Schurman and stand up luncheon.

Afternoon: College Forums and reconstruction schedule.

Evening: Formal University dinner with after-dinner speaking.

### SATURDAY, JUNE 21

Morning: Alumni Convention.

Afternoon: Baseball, Cornell vs. Pennsylvania. Golf and tennis tournament.

Evening: Class suppers in drill hall, followed by Cornelian smoker.

SUNDAY, JUNE 22

Morning: Unveiling of Statue of Ezra Cornell with addresses and military events.

Afternoon: Baccalaureate exercises.

Evening: Musical event.

MONDAY, JUNE 23

Fiftieth Commencement of the University.

**The "College Forum" of the College of C.E.**

At the approaching semi-centennial celebration of Cornell many of the alumni will return to Ithaca to renew their fraternal ties, to revisit the old scenes, and to do honor to the institution which during the fifty and more years of its prolific activity has done so

much for them.

But besides enjoying the pleasures afforded for them in this way Cornell's returning children will also have the opportunity of rendering an important service to their Alma Mater by attending and taking part in the special meetings arranged for the respective Colleges, that are to be held on Friday afternoon, June 20. For the alumni of each college there will be held on that afternoon a gathering which has been called a "College Forum" or "College Conference." In the last week of March the Faculty of the College of Civil Engineering appointed a Committee to prepare a programme for the "Conference" of the college, and Profs. S. G. George, F. J. Seery and I. P. Church were constituted such a committee, with the last named as chairman; and Dean Haskell has requested the following graduates of the College to act as "visiting alumni," viz.: Messrs. F. J. Knighton, 1891; I. W. McConnell, 1897; T. S. Clark, 1894; R. F. Proctor, 1901; and E. B. Whitman, 1901.

At this "Forum" or "Conference" of the College of Civil Engineering the special alumni who, by request, have made visits of inspection during April and May will read reports of their visits and make recommendation to improvements which in their opinion seem desirable both as to curriculum and material equipment. After this reading the alumni present will be invited to join in a discussion on the topics and recommendations brought out.

Following this discussion, should time permit, special topics connected with the work of the college will be presented for consideration, the discussion on each of these being opened by an alumnus who has accepted an appointment for that purpose. It is possible, however, that on

account of the limited time available some of these topics may have to be omitted.

The "Announcement of the College of Civil Engineering for 1919-1920" will be issued about the middle of May and it is intended to send a copy to each alumnus of the College. Every graduate, therefore, will thus be enabled to become familiar with the present status of the College and take part intelligently in any of the discussions of the "Conference."

The following programme, therefore, has been arranged:—

Address of Welcome

Statements of objects of Conference

Reports of the visiting alumni on the present state of the College as to equipment and curriculum; also on its present and future needs, and mode of getting both moral and material help from the alumni.

Reply of Faculty spokesman.

Discussion of these reports by the alumni present.

Informal short papers on talks by alumni on various topics, viz.:

1. What features of the curriculum have graduates found most helpful in their work since leaving college, and what additional features or substitutions would they have been glad to have?
2. Influence of war experience on future teaching of civil engineering.
3. The subject of "City Managers" in general, and whether the undergraduate course should have special features bearing on this kind of work.
4. English and public speaking in the undergraduate course.
5. The Art of Dealing with Men; and whether anything might be done in the curriculum to inculcate or develop this art.

#### **Tablet with Roll of Honor**

It is with considerable satisfaction that we are able to say that a suitable tablet has been placed in the University Library, carrying Cornell's Roll of Honor.

The present form will probably be replaced at some future date by a more permanent memorial; but it is most fitting that some recognition be made at this time of those who have made the one greatest sacrifice for their country. There are at present one hundred and eighty-five names on the list which is arranged alphabetically in five columns. As more names are received they will be added in groups of about twenty. The tablet consists of a wooden stand carrying the list of names headed by the superscription, "Roll of Honor," "Cornell University," and the Latin quotation, "Dulce et decorum est pro patria mori" which means "Sweet and Glorious is it to die for the Fatherland."



**Fellowship in  
Hydraulic  
Engineering**

Through the generosity of Elon Huntington Hooker, C.E., '94, Ph.D., '96, a fellowship in hydraulic engineering in the College of Civil Engineering has been provided for. Mr. Hooker has given stock of the value of \$8,500 to the University. In a letter presented by President Schurman to the Committee on General Administration Mr. Hooker wrote:

"Toward the College of Civil Engineering of Cornell University and the late Professor Estevan A. Fuertes, its Dean, and late Director, from 1873 to the time of his death in 1903. I have entertained for many years a feeling of the deepest gratitude,—toward Dean Fuertes as an inspiration of my early years as an engineer, and toward the College of Civil Engineering for the foundation in technical knowledge there given me on which I have been able to build much of my subsequent business life and to which I owe certainly a considerable part of any success attained.

... . After graduation from the College of Civil Engineering I was accorded the opportunity of two years' study abroad, through one of the fellowships of the University. . . . It is my desire to afford a like opportunity to other graduates and at the same time in some measure acknowledge my indebtedness to the late Dean Fuertes."

Mr. Hooker is president of the Hooker Electrochemical Company of Niagara Falls and of other corporations. His home is in New York.

## ALUMNI NOTES

'72. Sylvester N. Williams is Emeritus Professor of Civil and Sanitary Engineering at Cornell College, Mt. Vernon, Iowa, and has been active in that capacity since 1873, having been Professor of Mathematics, from December 10, 1872 to July 1873. He writes that he is the happy grandfather of twin daughters born to his oldest daughter on February 27, 1919. His home is at 734 Fair Oaks Ave., Oak Park, Illinois.

'73. T. Sidney White is Vice-President and Constructing Engineer of the Pennsylvania Bridge Co. at Beaver Falls, Pa.

'76. Charles W. Raymond of 811 H street, Sacramento, Cal., has dropped the practice of engineering and is now engaged in mercantile collections, at 318 Ochsner Building, Sacramento, Cal.

'77. David J. Macpherson has retired from business. He gives his address as 1120 Atchison St., Pasadena, California

'77. Eugene R. Smith is President of the First National Bank of Islip. His address is Islip, Suffolk Co., N. Y.

'78. W. Beahan, who is First Assistant Engineer for the New York Central Railroad, was recently elected a Director of the American Society of Civil Engineers. He resides at 2213 Bellfield Ave., Cleveland, Ohio.

'78. Edward Hayes is City Engineer of Cohoes, N. Y. His address is City Hall, Cohoes, N. Y.

'78. F. deP. Rodriguez is Lighthouse Engineer with the Board of Public Works of the Cuban Government. His address is 51 Virtudes Street, Havana, Cuba.

'81. Abram R. Bullis has his home at Macedon, N. Y.

'82. W. C. Trumbull is Assistant City Engineer for Oil City, Pa. He resides at 11½ Graff St., Oil City, Pa.

'87. W. E. Greenawalt is President of the U. S. Chemical Copper Company. He is the author of "Hydrometallurgy of Copper". His address is 85 South Sherman Street, Denver, Colo.

'87. John W. Meehan is a civil engineer residing at Mt. Vernon, Washington.

'88. Clarke Dillenbeck is Assistant Chief Engineer of the Philadelphia and Reading Railroad and the Central Railroad of New Jersey. His home address is 123 West Upsal Street, Germantown, Philadelphia, Pa.

'88. Edward J. Duffies of Washington, D. C., is U. S. Assistant Engineer, Office of Engineers, U. S. Army, War Department.

'89. I. C. Brewer of 334 Huron Ave., Sandusky, Ohio, is Superin-

tendent of Construction for the Liberty Potash Co., of Green River, Wyo. A plant is being erected in which the process of Guy Sterling, C.E. '87, is to be used for the making of potash from Wyomingite.

'89. John F. Hayford of 574 Ingleside Park, Evanston, Ill., is Director, College of Civil Engineering, Northwestern University.

'90. N. S. Crouch is with the Shepherd Engineering Company of Williamsport, Pa.

'91. Herbert Parsons gives his address as 635 W. 62d St., Chicago, Ill.

'91. Harrison Stidham is Captain in the Construction Division of the Quartermaster Corps U. S. A. He lives at 3322 Newark St., Washington, D. C.

'92. Walter I. Vose is a merchant at Manville, R. I.

'93. Ward P. Davenport of 40 Church St., Plymouth, Pa., is Superintendent with the Spring Brook Water Supply Company with offices at 114 W. Main St., Plymouth, Pa.

'93. Claude W. L. Filkins of 1701 Madison Ave., Scranton, Pa., is engaged in general civil engineering work at 725-6 Commercial Trust Building, Philadelphia, Pa.

'93. Robert H. Jacobs is Division Engineer for the Public Service Commission of the First District of New York. He is in charge of designs, purchase of material, and installation of tracks for the Dual System. He resides at 65 Park Ave., New York City.

'93. Benjamin F. Latting, Civil Engineer in the Signal Corps of the War Department at Washington, D. C., is residing at 140 U St., N. E., Washington, D. C.

'93. Elmer Zarbell is living at 2089 Sherwood Ave., Louisville, Kentucky. He is Assistant Engineer of the Louisville and Nashville Railroad.

'94. C. Morton Ayres is with the Central Iron and Coal Company as Chief Engineer, located at Holt, Ala. His home address is Box 392, Tuscaloosa, Ala.

'94. George G. Brooks is a civil and mining engineer located at the Scranton Life Building, Scranton, Pa. He can be reached at 1549 Jefferson Ave., Scranton, Pa.

'94. T. B. Bryson is a contractor with his office at 52 Vanderbilt Ave., New York City.

'94. Thomas S. Clark is Chief Engineer of the Alphons Custodis Chimney Construction Company of New York. He lives at 1436 East 17th St., Brooklyn, N. Y.

'94. M. A. Earl is a consulting engineer in Muskogee, Okla.

'94. Sidney E. Hunt is a minister in the Methodist Episcopal Church. His address is Portlandville, Otsego Co., N. Y.

'94. Clarence W. Marsh is a consulting engineer with offices at 101 Park Ave., New York City. His home address is 245 Millbank Ave., Greenwich, Conn. He has recently invented an improved process for the manufacture of chlorine and caustic soda. This process will reduce operation costs materially and power costs in particular.

'94. John W. Towle is President of the Omaha Steel Works. He was representative of the Emergency Fleet Corporation at Hog Island, Pa. and Wilmington, N. C. for seventeen months. His address is 3602 Pacific St., Omaha, Nebr.

'95. Charles W. Sherman, M.C.E. is Consulting Engineer with the firm of Metcalf & Eddy at 14 Beacon St., Boston, Mass. His home address is 16 Myrtle St., Belmont, Mass.

'95. John Weatherson is Captain Co. "I", 338th Infantry, A. E. F., France.

'96. Harry K. Runnette is living at 2231 Dexter St., Denver, Colo.

'96. R. H. Simpson is Engineer in Charge of River Channel Improvement as a Relief from Floods, Columbus, O. His address is 1748 Summit St., Columbus, Ohio.

'97. Homer C. Brown is a fruit grower living at Selah, Yakima County, Washington.

'97. Charles F. Hamilton is Treasurer and General Manager of C. F. Hamilton, Inc., Franklin, Pa. His home is 1407 Buffalo St., Franklin, Pa.

'97. Gilbert P. Ritter is a patent lawyer with offices in the McGill Building, Washington, D. C. His residence is at 1326 Fairmont St., N. W., Washington, D. C.

'97. Ira W. McConnell, formerly an instructor in the College of Civil Engineering at Cornell University, has been appointed Vice-President of the Dwight P. Robinson & Co., Constructing and Consulting Engineers, New York City.

'98. A. H. Horton of 1307 Gallatin St., Washington, D. C., is Hydraulic Engineer for the United States Geological Survey.

'98. M. A. Tenney of 4303 Walnut St., Philadelphia, Pa., is Inspector of Subway construction on the Philadelphia Rapid Transit System.

'99. A. P. Adair gives his residence as 15 Chester St., Allston P. O., Boston, Mass.

'99. Clifford H. Belden is Vice-President and General Manager of E. S. Belden & Sons, 217 Laurel St., Hartford, Conn. His home address is 28 Nathan Hale St., New London, Conn.

'99. Harry W. Dennis is Construction Engineer for the Southern California Edison Company. He lives at 329 South Reno St., Los Angeles, Cal.

'99. Charles C. More, M.C.E., is now located at 1312 Park Road, N. W., Washington, D. C. He is Major in the Engineer Corps, U. S. A.

'99. Friend P. Williams, formerly Division Engineer, Western New York Division, New York State Barge Canal, has been appointed Special Deputy State Engineer. L. C. Hulburt, '03, formerly Acting Division Engineer Eastern Division, succeeds Mr. Williams.

'00. J. D. Bailey is with the Buckeye Pipe Line Co. His address is 870 W. Market St., Lima, Ohio.

'00. George W. Penfield is Assistant Engineer on additional water supply for Hartford, Conn. His address is New Hartford, Conn.

'00. E. J. Strasburger is engaged in civil, mining, and consulting engineering with the Strasburger Civil and Mining Engineering Co., located at 614 Daly Bank Building, Butte, Montana. His residence is at 303 S. Idaho St., Butte, Montana.

'01. Earl B. Butchers is Captain in the 22d Engineers with the American Expeditionary Forces in France. His home address is Cambridge, Pa.

'01. Louis C. Giltner is Cashier in the National Bank and Trust Company at Nueva Gerona, Isle of Pines. His residence is in Columbia, Isle of Pines, West Indies.

'01. Nathan E. Young, living at 123 West Main St., Union, N. Y., is a road contractor.

'02. Albert H. Chandler of 361 Gates Ave., Brooklyn, N. Y., is Topographical Bureau Assistant Engineer, Queens Borough, New York City.

'02. Arthur E. Clark has been transferred from the grade of Associate Member to a Member of the American Society of Civil Engineers. He is Assistant Division engineer for the Public Service Commission of New York and may be addressed at 1932 Arthur Ave., New York City.

'02. Louis A. Mitchell is an engineer in the Maintenance of Way Department of the Union Traction Company of Indiana. His address is Anderson, Indiana.

'02. Harold B. Stevens is Field Engineer for the Carnegie Steel Co., at Clairton, Pa. His residence is in Masontown, Fayette Co., Pa.



'02. Bertrand H. Wait is with the Portland Cement Association, 15th St. and Madison Ave., New York City. His home is at 62 Montgomery St., Poughkeepsie, N. Y.

'03. Arthur R. Keller, is Captain of Engineers in the office of the Chief of Engineers, Washington, D. C. His temporary address is 2618 Garfield St., Washington, D. C. Upon discharge from the service he expects to return to his home in Honolulu, Hawaii.

'03. Ralph E. Marvin is engaged in civil and mining engineering with offices at 306 London Building, Vancouver, B. C.

'03. Charles R. Vanneman is Chief of Division of Steam Railroads, Public Service Commission, Second District, State of New York, and is also Acting Engineer of Grade Crossings. His address is 555 Providence Ave., Albany, N. Y.

'04. G. I. Morris, is Office Engineer, Bureau of Valuation, Interstate Commerce Commission, San Francisco, Calif. He lives at 319 Santa Clara Ave., Alameda, Calif.

'04. Chas. M. Reppert of 265 Noble Ave., Crafton Station, Pittsburgh, Pa., is Deputy Chief Engineer for the Passenger Transportation and Housing Division, Emergency Fleet Corporation, U. S. Shipping Board, with offices at 140 N. Broad St., Philadelphia, Pa.

'05. Nora Stanton Blatch has recently been married to Morgan Barney, Naval Architect, M. I. T., 1900. Her residence is 15 W. 91 St., New York City.

'05. W. S. FitzRandolph of Sloatsburg, N. Y., is an assistant on the staff of Claims Board, Bridgeport Ordnance Office. After May 1st he will be at 1328 Broadway, New York City.

'05. Thomas L. Fountain is a Captain of Engineers, U. S. R. His address is U. S. A. Post Office 701, A. E. F., France, Care C. O. 17th Engineers (Ry.).

'05. W. H. Gerwig is Assistant Treasurer and General Manager of the Bentley and Gerwig Furniture Co., Parkersburg, W. Va.

'05. Ephraim Viertels' home address is 776 Prospect Ave., New York City. He is an engineer at 1 Beekman St., New York City.

'06. Robert Coltman, Jr., is Assistant Engineer with Barclay Parsons & Klapp, Construction Engineers, and is engaged on construction of dry docks No. 6 and 7, Norfolk Navy Yard. His address is 1111 Colley Ave., Norfolk, Va.

'06. Edward A. Evans is an engineer for the T. A. Gillespie Co., 50 Church St., New York City. He lives at 511 W. 143d Street.

'06. Clarence E. Gruner was last heard from when he was with the Engineers of West Virginia. His home address is 810 Church St., Richmond Hill, Queens Co., N. Y.

'06. Ralph F. Shreve is Structural Engineer in the Power and Construction Department of the Ford Motor Company. His address is 294 Tuxedo Ave., Detroit, Mich.

'06. John Stearns is Construction Supervisor with the J. G. White Engineering Corporation, whose offices are at 43 Exchange Place, New York City. He gives his residence at 446 Ocean Ave., Brooklyn, N. Y.

'06. H. E. Weatherlow is Office Manager of Construction for the Raymond Concrete Pile Company of 140 Cedar St., New York City. He resides at 132 West 4th St., Mt. Vernon, N. Y.

'07. Clarence F. deClercq is an Assistant Engineer, Grade 2, State Highway Commission, Binghamton, N. Y. His address is 133 LeRoy St., Binghamton, N. Y.

'07. Burtis J. Finch is with the United States Bureau of Public Roads as District Engineer. His home address is at 6453 Calby St., Oakland, California.

'07. R. G. Ford is Supervisor for the Pennsylvania Railroad at Lock Haven, Pa. He lives in Bellwood, Pa.

'07. Antonio Lazo has been admitted to partnership in the firm of Bodell & Company and will be resident partner in charge of the New York office which is located at 120 Broadway.

'07. Paul B. Lum of 1361 Otis Place, N. W., Washington, D. C., is Assistant Manager of the Autocar Sales and Service Company of Washington, D. C.

'07. Donald P. Maxwell is a concrete engineer for the Aluminum Company of America, Pittsburgh, Pa. His address is 915 South Soles St., McKeesport, Pa.

'07. Clarence H. Swick is a geodetic computer for the U. S. Coast and Geodetic Survey, Washington, D. C. His home is at Capitol Heights, Md.

'08. D. C. Corwin is a superintendent with the Raymond Concrete Pile Co., at the Army Supply Base, Norfolk, Va. His residence is at 113 W. 34th St., Norfolk, Va.

'08. Lt.-Col. R. S. Dodson, F. A., is now stationed at St. Mihiel, Dept. of the Meuse, as Adjutant General of the Ninth Corps.

'08. H. S. Griswold is a retail lumber dealer living at 67½ Lincoln Ave., Binghamton, N. Y.

'08. Frank A. Kristal has recently been discharged from active service as Ensign in the Engineering Branch of the U. S. Navy and can be reached at 99 Montgomery St., Newark, N. J. He expects to be married in a few weeks.

'08. Bruno C. Lechler is General Manager of the S. S. Hepworth Co., 2 Rector St., New York City. His home address is 219 Kingsland Ave., Brooklyn, N. Y.

'08. George Paaswell is Section Engineer for the Public Service Commission of New York City. He resides at 212 West Fordham Road, New York City.

'08. John W. Taussig is Assistant General Manager for the Raymond Concrete Pile Co. His business address is 140 Cedar St., New York City, and his home address, South Dwight Place, Englewood, N. J.

'09. Edwin R. Bowerman of 203 E. Willow Grove Ave., Philadelphia, Pa., is Structural Engineer for the American International Shipbuilding Corporation at Hog Island, Pa.

'09. Ralph M. Bowman lives at 718 Ashland Ave., Buffalo, N. Y. He is Purchasing Agent for the Lackawanna Bridge Co., and is a member of the American Railway B. and B. Association, the Purchasing Agents Association, and an associate member of the American Society of Civil Engineers.

'09. Hart Cummin, living at 31 Bellevue Ave., Dayton, O., is Sales Engineer with the Pratt Iron Works Co. He reports Gaylord C. Cummin's address as 523 Terrace Ave., S. E., Grand Rapids, Mich.

'09. J. M. Felknor may be reached at Colusa, California.

'09. L. L. Graham of 506 Winsor St., Jamestown, N. Y., is Assistant Engineer of Water Supply at Camp Knox, Kentucky, which is to be a permanent camp.

'09. Herbert B. Hoyt is with the B. R. & P. R. R. as Superintendent of the Timber Preserving Plant. He lives at 300 South Ave., Bradford, Pa.

'09. Scott B. Lilly gives his address as 102 Cornell Ave., Swarthmore, Pa.

'09. Gustav J. Requardt is engaged in civil and sanitary engineering with offices at 1320 Munsey Bldg., Baltimore, Md. His residence is 704 Cathedral Street.

'09. C. B. Wigton is Manager of the General Contract Department of Levering and Garrigues Company, whose offices are at 552 W. 23d St., New York City. His home address is at 1353 Watching Ave., Plainfield, N. J.

'09. Harold H. Williams is Sales Engineer with David Lupton's Sons Co., 50 Church St., New York City. His home is at 53 Benson St., Glen Ridge, N. J.

'10. Patterson Bain, Jr., Salesman for the Certain-teed Products Corporation in Denver, Colo., his home address is 5727 Enright Avenue, St. Louis, Mo.

'10. James Conley is Resident Agent for the Cummings Structural Concrete Company, Ithaca, N. Y. He may be reached at 308 E. Seneca St., Ithaca, N. Y.

'10. William H. Hilborn is engaged in government housing work at Erie, Pa. He can be reached at 715 W. 8th St., Erie, Pa.

'10. Leon E. Jackson is Engineer for the Rochester Railway and Light Company, Rochester, N. Y. He is living at 40 Belmont Street.

'10. Louis C. Jennings is Resident Engineer on dam construction for the Foundation Co., Ltd., at St. Jecome, Quebec. His home address is 135 Pelham St., Newport, R. I.

'10 ('06 A.B.). Francis R. Nitchie is Priest-in-Charge, St. Matthew's Chapel, Seat Pleasant, Md. and All Saints' Chapel, Bennings, D. C.

'10. Rudolph F. Schaefer is located at 120 Broadway, New York City, as Structural Designer. His home address is 730 Church St., Richmond Hill, N. Y.

'10. H. R. Standiford is Construction Supervisor with the J. G. White Engineering Corporation, 43 Exchange Pl., New York City.

'10. George F. Unger is a civil engineer with offices at 322 Prudential Bldg., Buffalo, N. Y. His address is 31 Berkeley Place.

'11. Walter L. Conwell of 122 Bement Ave., West New Brighton, N. Y., is still in France as a Major and does not know when he will return.

'11. Pitt Covert, Jr., is an oil refiner at Casper, Wyo. He is residing at 366 C. Y. Ave., Casper, Wyo.

'11. A. Manuel Fox was recently promoted to Engineering Assistant to the General Valuation Counsel of the New York Central Lines. He lives at 131 Saratoga Ave., Yonkers, N. Y.

'11. G. S. Frank is a First Lieutenant in the 29th Aero Squadron which is located in France. His home is at Warsaw, N. Y.

'11. Edward J. Kelly, Jr., is a Second Lieutenant of Engineers and is attached to the 856th Company of the Transportation Corps. His home is at Corning, N. Y., but at present he is still at Le Havre, France.

'11. Charles H. Lord is now Superintendent of the Ogdensburg City Water Works. His grandfather had held that position from the

installation of the waterworks in 1863 until 1893 when he was succeeded by his son. His son, the father of the present superintendent, held the position until 1918 when Mr. C. H. Lord took control. Mr. Lord is living at 36 Pickering Street.

'11. Sewell Names is Construction Engineer for the Acheson Graphite Company of Niagara Falls and Buffalo, N. Y. His home is at 396 Wyoming Ave., Buffalo, N. Y.

'11. James B. O'Brien is located at Central Hershey, Province of Havana, Cuba, as an engineer.

'11. Leland S. Rhodes of 17 South 8th St., Lebanon, Pa., is Civil Engineer for the Bethlehem Steel Company, at the Lebanon Plant.

'12. J. K. Anderson is Civil Engineer with the Rust Engineering Company with offices at 504 District National Bank Building, Washington, D. C. His home address is 905 North Ave., Wilksburg, Pa.

'12. Armour W. Barbour is a salesman for the National Bridge Works, Long Island City, N. Y. His residence is at 523 West 112th St., New York City.

'12. Irving C. Clausz is an instrument man with the N. Y. C. R. R. His address is 1484 Westwood Ave., Lakewood, Ohio.

'12. Lewis H. Delany of Sheffield, Ala., is Civil Engineer with J. G. White Engineering Corporation and is helping to complete a plant designed to take nitrogen from the air, it being originally planned to make explosives for war purposes.

'12. Edward B. Holmes is acting as Mining Engineer with headquarters at Rio de Janeiro, Brazil. He is employed by E. J. Lavino & Company of Philadelphia, Pa. His home address is Keene, N. H.

'12. Peter Remsen of 2120 G. Street, N. W., Washington, D. C., is engaged in the designing and supervising of plans for concrete structures at the Bureau of Yards and Docks, Navy Department, Washington, D. C. Harold A. Axtell, '11, John Duba, '15, Jacob Fruchtbaum, '17, and Joseph Michaelson, '92, are all located at the same place.

'12. C. G. Stewart is Assistant Division Engineer, Illinois Division of the B. & O. R. R. His address is Box 612, Flora, Ill.

'12. C. Henry Trask is Resident Engineer at the Dupont Office, Williamsburg, Va.

'12. C. L. Wilson who has been discharged from the 472d Engineers, Southern Detachment, is now with the F. W. & D. C. Railroad as Accountant. His home is at 1222 Jennings Ave., Fort Worth, Texas.

'13. W. H. Barnard is Assistant Engineer of the Southern Railroad Lines at Charlotte, N. C.



'13. W. E. Brooks is General Superintendent of the H. C. Brooks Company. His address is Hagerstown, Md.

'13. P. DeWitt Brown is in the Engineering Department of the Carnegie Steel Company, Pittsburgh, Pa. His home is at "The Browning," Bemus Point, N. Y.

'13. N. W. Dougherty is Professor of Civil Engineering, University of Tennessee, Knoxville, Tenn. His home address is 1708 Cornell Ave., Knoxville. A daughter, Mildred Monteith, was born to Prof. and Mrs. Dougherty, Nov. 20, 1918.

'13. Charles D. Farlin lives at 28 Union St., Glens Falls, N. Y.

'13. Thomas H. McKaig is Manager in Charge of Buildings at the Schoellkopf Works, National Aniline and Chemical Co., Buffalo, N. Y. He lives at 18 Indian Church Road, Buffalo, N. Y.

'13. L. Spalding is Supervisor of Structures for the Bessemer and Lake Erie Railroad at Greenville, Pa. He resides in Greenville and may be addressed at Post Office Box 243.

'13. Morris A. Spamer is Engineer for H. D. Watts Co., Engineers and Contractors, working on housing development, at Wilmington, Delaware. His permanent address is Care of A. L. Spamer, U. S. Court, Baltimore, Maryland.

'13. Harry G. Specht is Industrial Engineer with C. E. Knoeppel & Co., 101 Park Ave., New York City. His home address is 335 E. 68th Street.

'13. R. S. Wait has been reinstated as City Engineer, Norwich, N. Y., after service as First Lieutenant in the 301st Field Artillery, A. E. F. He was married to Miss Mildred Curtis on January 28, 1919 at New York City.

'14. Myron A. Allen is Chief Estimator for Fred T. Ley & Co., Springfield, Mass. His home address is 42 Spruceland Ave., Springfield, Mass.

'14. Carlos F. Bidgood is Supervising Inspector on Construction Work for the Department of Public Works, Navy Yard, Washington, D. C. His Home address is 381 Myrtle Ave., Albany, N. Y.

'14. Otho M. Clark is Sales Manager of the Kosmos Portland Cement Company. He was discharged from the army January 1, 1919 as a Captain of Engineers. His home address is 1330 Cherokee Road, Louisville, Ky.

'14. Arthur M. Field, who was recently discharged from the Coast Artillery Service is now Secretary of the Chamber of Commerce at Winchester, Va.

'14. Charles Kirschner was married on January 23, 1919, to Miss Edna LeBesque, of New Orleans, La. He is with the Bureau of Public Roads, Department of Agriculture, as Drainage Engineer, and is located at Tulane University, New Orleans, La. He resides at 1327 Esplanade Ave.

'14. Edwin T. McDowell is Superintendent and Engineer for the Middletown Water Works, Middletown, Conn. He may be addressed at 77 S. Main St., Middletown, Conn.

'14. W. E. Nussbaum is Municipal Engineer for the Palmer Land Company (N. J. Zinc Co. of Pa.), Palmerton, Pa. His permanent address is 128 South First St., Lehighton, Pa.

'14. E. C. Panton is Assistant Engineer with the U. S. R. S., King Hill, Idaho.

'14. Ralph W. Powell, is studying the Chinese language at Peking, China. He taught the last two years at "Yale in China," Changsha, and expects after this year to finish a six years' term. He may be located at Methodist Mission, Peking, China. His parent's address is Ionia, Mich., R. D. No. 1.

'14. G. G. Robinson is Promotion Engineer for the Canada Cement Company, Ltd. He is staying at the King Edward Hotel, Toronto, Can.

'14. F. L. Rockwell is residing at 392 N. Main St., Wellsville, N. Y. He is Vice-President, Treasurer and General Manager of the Victor Aluminum Manufacturing Company of that place.

'14. Russell A. See is Assistant Engineer with the U. S. Reclamation Service. His address is U. S. R. S. Camp No. 16 Morrill, Nebraska.

'15. E. S. Baker is with the Boldt Construction Company, 6110 Euclid Ave., Cleveland, Ohio. His home address is 18144 Clifton Road, Lakewood, Cleveland, Ohio. He writes that J. C. F. Shafer, '05, is the Vice-President of the above firm.

'15. Paul Cohen has changed his address to 569 West 150th St., New York, N. Y. where he is located with E. E. Seelye, '04, Consulting Engineer.

'15. Clinton L. Corbet of 5638 Blackstone St., Chicago, Ill., is at present in France as a 2d Lieutenant in the Aviation Section of the U. S. Army.

'15. Frederick E. Hertel is Material Supervisor on sub-contract work at Hog Island, Pa. His home is at 1933 South 65th St., Philadelphia, Pa.

'15. Henry G. Lehrbach is Civil Engineer in the United States Navy.

'15. Morris Stone is Senior Inspector of Raw Material, Cannon Inspection Division, Watervliet Arsenal, Watervliet, N. Y. He gives his temporary address as Y. M. C. A., Albany, N. Y., and his permanent address as 38 Lincoln Ave., Amsterdam, N. Y.

'15. Howard B. Wright is now in the Estimating Department of the Sinclair Oil Company. His home is 6565 Yale Ave., Chicago, Ill. He writes that C. M. Briggs, '17, is in the Engineering Department of the same firm.

'15. Oscar E. Zabel is with the Engineering Department of the Taylor Instrument Company of Rochester, N. Y. His home address is 118 Clifford Ave., Rochester, N. Y. He was in the Ordnance Corps of the U. S. for 10 months as Engineer on Large Gun Forgings.

'16. Captain Stuart S. Caves is with the 304th Motor Truck Divisional Supply Train A. E. F. His address is A. P. O. 771, France.

'16. W. L. Havens is Assistant Sanitary Engineer of the City of Cleveland. He lives at 12319 Osceola Ave., Cleveland, Ohio.

'16. Second Lieutenant H. C. Kibbe, 307th Engineers, spent Christmas at Nice. He has seen considerable action.

'16. H. S. Lee is Assistant Engineer with the Chile River Commission at Tientsin, China.

'16. C. A. McClain, M.C.E., is General Superintendent and Secretary for the Eugene Water Board operating electric and water plants for the City of Eugene, Ore. His home is at 1033 High street.

'16. Second Lieutenant T. C. Rogers, who was with the 117th Field Artillery, 31st Division, has returned from France and has been discharged.

'16. Otto C. Vieweg was honorably discharged as a Sergeant in Aerial Photography. He resides at 161 DeWitt Ave., Elmira, N. Y. At present he is with the Engineering Department of the Elmira Water, Light and Railroad Company.

'17. David Beale is with the American International Corporation at 120 Broadway, New York City. He was a Major in the Coast Artillery. His home address is 133 Abbott Road, Wellesley Hills, Mass.

'17. George F. Buckman is a draftsman and Assistant Shop Engineer in the machine shop of the New York Ship Building Corporation at Camden, N. J. His present address is Y. M. C. A., Camden, N. J. He informs us that Jim Van Campen is with the Camden Forge Co. at Collingwood, N. J.

'17. Robert F. Edwards is in the State of Montana with the Water Resource Branch of the United States Geological Survey. He is temporarily located at the Y. M. C. A., Helena, Montana.

'17. Paul Fein is Assistant Engineer of the Walter Kiddle and Co. New York City. He writes that a Union of Engineers has been organized in New York and is growing powerful. He lives at 1014 Eastern Parkway, Brooklyn, N. Y.

'17. J. Fruchtbaum of 239 Newport Ave., Brooklyn, N. Y., is a draftsman in the Bureau of Yards and Docks, Navy Department Washington, D. C. He informs us that Lieutenant M. Berstein, '16, is Commanding Officer of Company I, 36th Infantry, Regular Army.

'17. George Gordon is with Headquarters Company, 302d Engineers, A. E. F. in France.

'17. John J. Gromfine is a First Lieutenant with the 3rd Engineers stationed in the Canal Zone. His present address is Corozal, Panama, Canal Zone.

'17. Max Gross, after serving eight months in a Machine Gun Company, has been discharged from the army and is a draftsman in the Gas Department of the Riter-Conley Mfg. Co., Leetsdale, Pa. His home address is 752 Quincy St., Brooklyn, N. Y.

THE CIVIL ENGINEER desires information concerning the location of the following men:

Bauer, C. F., '13.

Dorsey, John G., '16.

Kaufman, Abraham, '15.

Makepeace, Mervale D., '75.

McPherson, K. W., '09.

Scheckel, Wm. B., '17.

Smith, W. C., '85.

Storey, Frank S., '02.

## BOOK REVIEWS

*Sewage Disposal.* By Kinnicutt, Winslow and Pratt, Second Edition, Cloth 8 vo. pp. xvii+547. John Wiley & Sons, New York, Chapman & Hall, Limited, London. Reviewed by C. L. Walker, Assistant Professor, Civil Engineering, Cornell University.

Professor C. E. A. Winslow, of Yale University and R. Winthrop Pratt, Consulting Engineer of Cleveland, Ohio, under date of 1919 have issued a second edition of the book on Sewage Disposal, published by the late Leonard P. Kinnicutt and themselves in 1911.

A comparison of the present with the previous edition readily convinces one that the authors have been successful in their effort "to rewrite the last edition completely so as to bring in new data and recent view points in connection with all the topics treated." In each chapter changes involving the addition of new text and illustrations, the omission of subject matter and illustrations, rearrangement of content for more logical presentation, or the addition of new sub-topics are frequent and aid materially in increasing the usefulness and value of the book.

The more important changes include the following: The incorporation, as a part of the text of the new edition, of the introduction of the first edition in chapter one; the emphasis of the treatment of manufactural wastes and of bacteria in sewage; the emphasis of the problem of dispersal of sewage in chapter two; a more extended treatment of screening in chapter three; a more lengthy discussion of sedimentation in chapter four; the introduction of subject matter dealing with the Miles Acid process and a much needed word on the cost of electrolytic treatment in chapter five; the formation of a new chapter on Preliminary Treatment of Sewage in Two-Story Tanks, part of the subject matter being taken from the previous edition and much new material being added; the addition to chapter eight of a short description of the Moscow sewage farm, in addition to those described in the first edition; the introduction of a chapter on Treatment of Sewage by the Activated-Sludge Process dealing with the history of the process, and supplying information made available as a result of the work done in Brooklyn, Milwaukee, Cleveland, Houston, and Chicago; the emphasis, in a new chapter, of General Considerations in Regard to Design and Operation of Sewage Treatment Plants, and the inclusion of a chapter dealing with the proper Disposal of Sewage and Excretal Wastes in the Absence of a Sewerage System.

The work has been so well rounded out in the present revision as to make it of much value to those who desire or require a comprehensive view, in relatively small compass, of the changes occurring in each method of treatment and of the question of proper design to obtain satisfactory results with each type of plant, though no attempt has been made to give such detailed information as would apply to sewages of varied character and composition.

*"Conveyance and Distribution of Water,"* by Edward Wegman, 1918, D. Van Nostrand Co., New York City. Cloth 6"x8" pp. 663, Illustrated; \$5.00 net.

Reviewed by F. J. Seery, Asst. Professor of Hydraulics, College of Civil Engineering, Cornell University.

The writer of this book on waterworks engineering is the well known author of the encyclopedic work on the Design and Construction of Dams and also of the notable History of the Water Supply of New York City. He has been for many years connected with the Aqueduct Commission as an engineer and for some time has been



conducting a practice as a consulting engineer specializing in hydraulic engineering in general, and dams in particular. As his life has been spent in the field of water-works engineering he knows his subject in a very practical way and his new book is distinctly a practical work. It is full from cover to cover with practical data and discussions. It is a book designed primarily for the water works engineer or superintendent, altho a student will find much of interest and value in it. It is not a text book of water supply engineering, but is mainly a compilation of matter relating to the conveyance and distribution of water, treated topically and without any well defined scheme of correlation. No one man, however large his experience, can have encountered all the problems and phases of water works, and so it is natural that Mr. Wegman has drawn on the large sources of knowledge that are available to supplement his own experience. In fact a large part of the contents of this stout volume is compiled from the page of the water works journals, supplemented with extensive extracts and cuts from trade publications.

Quite naturally the New England Water Works Journal is quoted extensively and considerable prominence is given to the data of the Metropolitan Water Works of Massachusetts. A considerable body of figures relating to water consumption is made available and cover American, British, French and German cities of all sizes.

A review of the hydraulic theory of flow in pipes covers 28 pages and follows the standard type of treatment usually found in textbooks.

A very large amount of space is devoted to descriptions of the common materials of water works construction. Cast-iron pipe is not slighted, wood pipe is particularly well covered, and very complete details relating to universal pipe, leadite, leadwood, etc., are given.

There is an extended abstract from Mr. Thos. H. Wiggin's discussion of the manufacture and inspection of cast iron pipe originally published in the N. E. Water Works Journal.

The theory and practice of designing and constructing riveted pipe is particularly complete, including an extensive discussion of many types of joints for assembling machine made pipe. An entire chapter of ten pages is devoted to flexible joints and is followed by a chapter of 22 pages on the construction of subaqueous pipe lines. The completeness of detail and scope of treatment may be inferred from the space devoted to such topics as valves which receives 22 pages, fire and other hydrants cover 16 pages, etc.

Chapter 16 is devoted to intake structures and a most interesting account is given of the works built at Chicago, Milwaukee and other places.

In his treatment of aqueducts, ancient and modern, naturally the structures on the Croton and Catskill systems of New York City are given most attention, but plenty of space is also devoted to the Weston aqueduct at Boston, the Los Angeles structures and many other notable works. For a practical work one would expect to find more cost data given on conduits of unusual types.

The chapter on fire protection is brief, being an abstract of the publications of the National Board of Fire Underwriters. While the materials of water works engineering are very fully discussed, the problems of maintenance and operation are not over looked and very interesting chapters on electrolysis, waste detection, meter testing, etc., are provided. One of the best chapters in the book is that relating to water meters, in which the characteristics of most of our American meters are considered and a large number of British, French and German types of meters are also covered. Valuable appendices contain the standard specifications for water works materials and many useful and practical tables.



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1918-1919 C. E. Board

# THE CORNELL CIVIL ENGINEER

and

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## A PROBLEM ON THE HYDRAULIC RESISTANCE OF A BRIDGE OVER THE CHEMUNG RIVER AT ELMIRA, N. Y.

S. C. George, C. E., '05 and E W. Rettger, Ph.D..

The Chemung River flood of June 1, 1889, was one of the largest floods recorded for the eastern part of the United States. Many cities located on this river were flooded and a great deal of damage was done. Naturally this flood made a very deep impression upon the minds of those who witnessed it.

At Elmira, N. Y., it is now proposed to replace the present steel bridge over the Chemung River at Main street by a modern concrete arch bridge. The present bridge has five piers while the proposed bridge would have seven piers. If the new bridge is built as designed, the high water mark of the June flood of 1889 would reach well up into the arches, consequently the new bridge would offer considerably more resistance to the flow of the water in the river in case another flood of such magnitude as that of 1889 should recur.

Since 1889, dikes have been built along the river in order to restrict the flow within the river channel proper. Assuming that these dikes are effective the entire volume of water, therefore, would have to be taken care of by the river itself, and the depth of the river would be increased in case of a flood of such magnitude as that of 1889. The high water mark would be raised, therefore, for two reasons.

First—The new bridge would offer more resistance to the flow of water in the river, and

Second—The volume of water flowing in the river channel would be increased.

One point affecting the feasibility of the new bridge, involved the determination of the probable rise of level of the water above the bridge due to the interference offered by the bridge.

This problem was presented to the writers and the method of attack and the solution will be given in this article.

#### PRELIMINARY CONSIDERATIONS

The data submitted with the problem were as follows: The cross sections of the stream, the plans of the existing bridges and the high and low water elevations at three bridge crossings of which the Main street crossing was the farthest upstream; also the plans for the new bridge; and the fact that there was an extremely high flood in June 1889.

A first consideration was the magnitude of the discharge,  $q$ , of the stream in the flood of 1889, and the probability of the occurrence of a larger flood. The information was furnished that the flood discharge of the stream was not known and that the records of the flood of 1859 had been destroyed by fire. This situation demanded, as is usually the case, a search of available engineering literature and reports, in order to establish the necessary facts. The following procedure was adopted:

A—Reports of the United States Geological Survey consisting of the stream discharge measurements recorded in the Water Supply and Irrigation Papers were examined. In these papers, discharge tables for the Chemung River were found for a gaging station a few miles below Elmira, with reference to a report made on the flood of June 1889 by Francis Collingwood, C. E.

B—The report of Mr. Collingwood was fortunately discovered in a report of the Common Council of the City of Elmira on the shelves of the University Library.

C—Reports of the New York State Barge Canal, the American Civil Engineers' Pocket Book, Merriman's Hydraulics, Church's Hydraulics, Alvord and Burdick's "Relief from Floods" and copies of U. S. G. S. topographic maps were also consulted.

From these sources of information it was found that the extreme flood of 1889 involved a discharge of 138,000 cubic feet per second, and that this flood in all probability would not be equalled in a century, and the chance of a higher flood appeared to be negligible.

To carry out such an investigation, it was necessary to know the cross section of the stream at Main Street during maximum flow and also the maximum amount of water flowing at this place. From the drawings furnished the cross section of the stream at maximum flow at each of the three bridges (Main street, Railroad and Lake street) can be computed. From the high water marks recorded at the three



bridges, an approximation to the slope of the stream can be obtained, and by means of Kutter's formula, an approximation to the maximum amount of water flowing in the stream itself can be calculated. On account of the overflow and the change in width of the stream between the Main street and the Lake street bridges, the coefficient of roughness to be used in Kutter's formula is somewhat uncertain. The first thing to do therefore was to examine such local records and reports as might be available. The Report of Francis Collingwood, C.E., on the flood of June 1, 1889 (printed in the Proceedings of the Common Council of Elmira, 1889-1890) is of special interest. This report gives a great deal of valuable information. The maps and drawings mentioned in this report were not available.

From this report it seems that the maximum flow of water was the enormous quantity of about 138,000 cubic feet per second which is equivalent to about 67 cubic feet per second per square mile of drainage area. Mr. Collingwood also stated that the overflow (the water flowing outside the river proper and flooding the land adjacent to the river) was estimated to be between 15,000 and 25,500 cubic feet per second. Taking this overflow at 20,000 cubic feet per second, the flow in the river channel must have been about 118,000 cubic feet per second.

As a check, the difference between the high water mark recorded at the Main street bridge and that recorded at the Lake Street bridge was taken as the fall of the river between these two bridges.

Using Kutter's Formula for the determination of the flow in a stream the maximum flow in the river near the Lake street bridge was found to be about 118,000 cubic feet per second, the same as that assumed above. As a second check, advantage was taken of a statement made by Mr. Collingwood in his report. This statement is to the effect that a drop in the water level at the Lake street bridge was about seven inches (7"). This drop was the difference between the high water marks just above and just below this bridge. Using a generally accepted method of calculation for the determination of the drop in water level due to interference by piers of a bridge, computations for a flow of 118,000 cubic feet per second gave a drop in water level at the Lake street bridge of about seven inches (7"), the same as that actually recorded. It will be assumed, therefore, that the flow in the river channel was 118,000 cubic feet per second.

The agreement between the drop in the water level at the Lake street bridge as determined theoretically and as actually observed, is of considerable moment, for it gives a check upon the validity of the method of calculation used for the Main street bridge. At the present Main street bridge, the high water mark is given as 857.00 feet

but the drop in level is not given. Using the same method of calculation as that used for the Lake street bridge, it was found that the drop in level at the Main street bridge must have been about five and one-fourth inches ( $5\frac{1}{4}"$ ), assuming, of course, that the 118,000 cubic feet per second flowed under this bridge. That is, if the present Main street bridge had not been there at the time of this flood, the river channel could have maintained the flow of 118,000 cubic feet per second, with a high water mark elevation of 856.56', or about  $5\frac{1}{4}"$  lower than that actually recorded in the June flood of 1889.

Assuming now that the present Main street bridge had been replaced by the proposed concrete arch bridge at the time of this flood, the same method of calculation shows that the probable drop in water level would not have been more than eleven inches (11") in order to maintain the flow of 118,000 cubic feet per second. That is, if the new proposed concrete arch bridge had been in place at the time of the flood, the river channel could have maintained the flow of 118,000 cubic feet per second with a probable high water mark elevation of not more than 857.46', or about  $5\frac{1}{2}"$  above that actually recorded in the June flood of 1889.

Since 1889, dikes have been built and other improvements have been made for the protection of the city against floods. No doubt still others will be made in the future. Assuming now that these improvements are such that, in those circumstances, the entire flow of 138,000 cubic feet per second would be confined in the river channel, the question arises,—What will be the probable high water mark with the proposed concrete arch bridge in place? To answer this question the following procedure was adopted:

1st. Using Kutter's standard formula for the flow of water in rivers, the probable high water mark at Main street may be determined on the assumption that the Main street bridge and piers *were not there* and that the 138,000 cubic feet per second is flowing in the river channel. On these assumptions the probable high water mark is found to be 858.50' or 1.5' higher than that actually recorded in June 1889.

2d. Assuming now that the new bridge is in place, the probable drop in water level may be determined by the same method as used above in the case of the Lake street bridge and the present Main street bridge. This drop was found to be about one foot (1'). As a result, the probable elevation of the final high water mark would be 859.5' or about 2.5' above that actually recorded in the June flood of 1889.

At this point it seems desirable to refer again to the report made by Mr. Collingwood with reference to his recommendations for improving the regimen of the river. Such improvements involve a more uniform

cross section, better slopes along the thread of the river and the modification of all sources of obstruction and resistance. The accumulated obstruction to the main channel in the widened reaches of the river by the formation of gravel deposits are primarily to be made the subject of investigation. Corrected sections should be made to correspond to those where the river is known to be contained within its natural banks, and should be neither much greater nor much smaller. The operations of obtaining aggregate for concrete construction might perhaps be so planned as to result in some of these improvements without much additional expense. A local deepening at the site of the bridge would not be of any pronounced value since these unnatural excavations would very soon be filled again.

As a general summary of the foregoing investigations it seems that *the high water mark at the Main Street bridge* (the proposed concrete arch bridge in place, and the entire 138,000 cubic feet per second flowing in the river channel) *will probably never be more than 859.5', or about 2.5' above that actually recorded in 1889, and in our opinion, such a high water mark will result in no serious consequences so far as flooding of the bridge is concerned.* It should be remembered that the drop in the water level (which would not be more than one foot, due to the interference by the piers of the bridge), would begin a little above the bridge. Under the bridge the level would be even lower than that just below the bridge. Even assuming that the water under the bridge would reach the elevation of the high water mark (859.5'), there would still be a clearance under the end arches of about 2.6' and under the center arches of about 6.7'. It should also be remembered that the velocity of the water under the bridge and just above the bridge would be considerably greater than that some distance above or below the bridge, since the highest point of the bridge is at midspan. The result of this is obvious. The increased velocity of the water at the bridge would help to keep the stream at the bridge free from the accumulation of debris or from the accumulation of such floating material as may come down the stream during a big flood.

The increased elevation of the high water mark above the new bridge may result in an overflow or may cause some damage to property adjacent to the river. This is a matter that should be investigated.

In conclusion, the details of some of the final calculations that were involved in the determination of the above results will be given. It should be mentioned that calculations were made for a variety of combinations of data or assumptions to provide a general check upon the results and to delimit the extremes between which the actual results following the installation of the new bridge would be found.

## DETAILED CALCULATIONS

It is a well known fact that the piers of a bridge cause the water just above the bridge to be at a higher level than that of the water just below the bridge.

Let  $B$  = original width of stream (no piers).

$b$  = contracted width =  $B$  — sum of widths of all piers in the stream.

$D$  = original depth (no piers) = depth just below bridge.

$H$  = amount water above bridge rises due to the interference of piers, that is,  $H$  equals drop in water level between two sides of bridge.

$q$  = discharge in cubic feet per second.

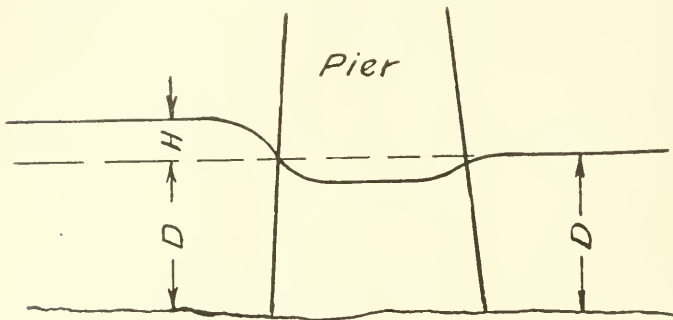


Fig. 1

$$h = \frac{v^2}{2g} = \text{velocity of water just above bridge.}$$

We then have

$$(1) \quad c\sqrt{2g} \left[ \frac{2}{3} B (H+h)^{\frac{3}{2}} + bD (H+h)^{\frac{1}{2}} \right] = q$$

This form of the well known equation is given by Merriman in his *Hydraulics* p. 327 (Ed. 1910). In the above equation,  $c$  is a coefficient and varies from 0.80 to 0.90 depending upon the form of the piers and their cutwaters.

## APPLICATION TO THE LAKE STREET BRIDGE

At the Lake street bridge (using flood of 1889 as a basis),  $D+H=20.3$  and therefore,

$$D = 20.3 - H, B = 546', b = 531', q = 118,000 \text{ cu. ft. per second, } v = \frac{q}{F} = 10.6 \text{ ft. per sec., and } h = \frac{v^2}{2g} = 1.75'. \text{ With an average value for } c, (c = 0.85), \text{ the above equation simplifies to,}$$

$$0.686^{3/2} (H + 1.75) + (20.3 - H) (H + 1.75)^{1/2} = 32.54$$

By trial,  $H$  is found to be,

$$H = 0.58' = 1\frac{1}{2}', \text{ or } 7'',$$

(The same as that actually recorded in the big flood of 1889).

#### APPLICATION TO THE PRESENT MAIN STREET BRIDGE

The width of the stream at Main street, that is, the distance between abutments, is given as 789.41' on the map furnished us. From the same map it seems that there are buildings built into the channel at one end of the bridge. Deducting for these buildings, the width of the channel was taken as  $B = 774'$ , and the contracted width was found to be

$b = 750'$ , using the flood of 1889 as a basis,

$D + H = 17.33'$  as the average depth of water just above the bridge

(or  $D = 17.33 - H$ ),  $q = 118,000$ ,

$F = B \times D = 13,410$  sq. ft.,

$v = \frac{q}{F} = 8.8'/\text{sec.}$ ,  $h = \frac{v^2}{2g} = 1.20'$ . Taking  $c = 0.85$ , the same as was

assumed for the Lake street bridge.

Equation (1) simplifies to

$$0.688 (H + 1.20)^{\frac{3}{2}} + (17.33 - H) (H + 1.20)^{\frac{1}{2}} = 23.05$$

By trial  $H$  is found to be

$$H = 0.43' = 5\frac{1}{4}''$$

and therefore

$$D = 16.9'$$

as the average depth just below the bridge with 118,000 cubic feet per second flowing in the river channel.

If the total distance (789.41') between abutments had been taken as  $B$ , the value of  $D$  (with fixed depth above bridge) would have been a little more but not enough to make any practical difference.

#### PROBABLE AVERAGE DEPTH AT MAIN STREET ASSUMING NO PIERS

$q = 138,000$  cubic feet per second.

Write Kutter's Formula in the form

$$v = A\sqrt{Rs}$$

where  $A$  is a coefficient,  $R$  the hydraulic radius, and  $s$  the slope. Consequently the discharge may be written

$$q = Fv = B \times D \times A\sqrt{Rs}$$

where  $B$  = width, and  $D$  = average depth. For streams very wide in comparison to their depth, the hydraulic radius is practically equal to the average depth. That is, we may put  $D = R$ .



For an increase of flow from 118,000 to 138,000 cubic feet per second, in a stream of such width as that of the Chemung River, the coefficient,  $A$ , and the slope,  $s$ , do not change appreciably. Consequently

$$138,000 = A \times B \times R_2^{\frac{3}{2}} \times s^{\frac{1}{2}}$$

$$\text{and } 118,000 = A \times B \times R_1^{\frac{3}{2}} \times s^{\frac{1}{2}}$$

From which we obtain

$$\left(\frac{R}{R_1}\right)^{\frac{3}{2}} = \frac{138,000}{118,000} = 1.17$$

$$\text{or, } R = 1.115, R_1 = 1.115 \times 16.9' = 18.83' = D$$

The probable average depth at Main street (no piers) would be therefore

$$D = 18.83'$$

for  $q = 138,000$  cubic feet per second.

#### PROPOSED BRIDGE IN PLACE. AVERAGE DEPTH JUST ABOVE BRIDGE

After a number of trials, it was found that the drop in water level will be about one foot. Assume, therefore  $H = 1$  ft. Then the average depth just above the bridge  $= 19.83'$ .

Assume now that the buildings mentioned as projecting into the channel at one end of the bridge will be removed in time,  $B = 789.4'$ ,  $F = 789.4 \times 19.83 = 15640$  sq. ft.

$$v = \frac{q}{F} = 8.83' / \text{sec. and } h = \frac{v^2}{2g} = 1.21'. \text{ It may be noted that if the}$$

value of  $B$  had been lessened on account of these projecting buildings, the value of  $H$  would not have been materially different. The total area of the side of the bridge that would be submerged (piers and part of the bridge above piers) was calculated as 1672 sq. ft. Therefore, on the average,

$$b = 789.4 - \frac{1672}{19.83} = 703'.$$

The coefficient,  $c$ , was taken as  $c = 0.80$ . Equation (1) then reduces to

$$(H + 1.21)^{\frac{3}{2}} + 25.18 (H + 1.21)^{\frac{1}{2}} = 40.9$$

From this equation, it is found by trial, that

$$H = 1 \text{ foot}$$

the same as assumed above. The probable average depth of stream above the proposed bridge would therefore be 19.83'. That is, the probable high water mark would be 2.5' above that actually recorded in the big flood of 1889.

# STREET DEVELOPMENT AFTER THE WAR

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In the interval while industry is readjusting itself to after-the-war conditions, it falls partly to the government to provide, perhaps temporarily, for the large quantity of labor that has been released from war activities.

The various local governments, therefore, should plan ways and means for meeting this situation. Necessary public improvements seem to offer the readiest means for giving immediate employment to large quantities of skilled and unskilled labor.

In most cities there are needed improvements which can be undertaken at short notice, if suitable plans are made in advance. The most obvious of these consists in improving street systems by paving and repaving streets, extending sewers, water mains and other utilities and by developing much needed boulevard systems to provide convenient access to parks. Herein will be suggested steps believed necessary in the preparation of a comprehensive street development program of this kind.

## MEANS OF APPROACH

There are two ways in which this problem may be approached. The most obvious way, and the way in which similar problems generally have been approached in the past, would be simply to list the streets in need of paving and repaving and to decide arbitrarily on the type of pavement surface to be provided in each case. The pavements then would be constructed according to general local practice, probably with a single standard of construction throughout and for all streets. Only the type of surface might vary from one street to another, and that but little. The paving program would consist then only of this list of streets arranged in the tentative order in which the work would be done. Such a program would be simple to prepare, uneconomical to follow and inadequate to meet the needs of the city.

The preferred way of handling the problem would be to base the program on a scientific study of conditions to be met; to design each pavement as a structure suitable to serve economically the purpose for which it is intended, and to develop the street system not as chance has made it but as utility would direct.

The street system is the most important of the city's transportation facilities. Especially where motor trucking plays a particularly important part in handling both the incoming materials and the out-

going products of local industry, the street system should be developed to meet the needs of industry, as well as the general public, in the most suitable and economic way. Important factors to consider are the shortness of routes between local shipping points, and the ability of pavements built on such routes to stand up under the traffic conditions imposed upon them. Both factors may be sub-divided, and both require careful scientific analysis and study.

#### THE LAYOUT OF THE STREET SYSTEM

It seems trite to state that the purpose of a street system is to provide ready means of transportation and communication between different points in the city, as well as entrance to the city from the surrounding country. But the layout of most street systems plainly indicates that little thought was given this purpose in the original platting of the streets. Moreover, the purpose includes, by inference at least, not only that the direction of the main streets shall be such as to provide the shortest possible routes between any two given points of importance, but that the routes so provided shall be passable and attractive to traffic. This means that layout and type of construction must be considered together.

In order that the purpose of the street system may be fulfilled it is essential that the points between which short, direct, passable routes are required shall be known. This information can be had in two ways. If the street system is to be laid out in undeveloped territory, as in a new city or town, the future location of important industrial, commercial and social centers can arbitrarily be decided upon in advance. But if the street system is to be developed to meet the needs of an older and well built up territory, the actual location of established industrial, commercial and social centers must be determined and the street system improved and developed in accordance therewith.

To the business man the cost of local transportation by team or motor truck is a considerable item both for incoming materials and outgoing products. This cost of motor trucking will range from 10 or 15 cents per ton-mile on well paved streets to 30 or 35 cents per ton-mile on unpaved or poorly maintained streets. If long detours are necessary because of poor pavements or traffic congestion or lack of direct routes, the cost mounts in proportion. Drivers of motor trucks will go considerable distances out of their way to avoid rough pavements or unpaved streets. Any delays caused by traffic blocks, or slackening of speed below the normal because of poor pavements, directly affect the cost of transportation. Therefore, apart from the matter of convenience, it is a matter of dollars and cents to a city's industry to provide direct passable routes between local shipping points.

The solution of this problem means the laying out of a system of main and intermediate thoroughfares in accordance not always with present traffic channels, but with the location of what may be called local terminals. Traffic will follow the shortest route if that route is made attractive by being smoothly and substantially paved and by being kept free from traffic obstructions and holdups which occur on narrow, poorly designed streets. Moreover, much expense for snow removal in winter can be avoided and traffic will be more adequately cared for by concentrating attention upon a comparatively few main thoroughfares instead of attempting to keep all streets open at all times.

Another thought enters here, and that is the importance of controlling the direction of the future industrial growth of a city. It is costly enough to design and construct a system of thoroughfares to meet existing conditions without contemplating the possibility of unregulated industrial building making necessary changes in the system within the next few years. A mile of asphalt pavement 50 feet in width would cost, on a pre-war basis, about \$59,000. No more of such pavements than are absolutely necessary should be built. The existence of a well laid out street system will, in itself, tend to direct industrial growth as it should go, but it is wiser to provide governmental regulation of building (zoning restrictions) than to chance the future without such control. Hence the problem of zoning is closely related to the problem of street layout. Much the same physical data must be considered in both problems, and the fitness of the solution of each is dependent upon the other. Both must recognize not only the present location of industries but also peculiar advantages of site, such as convenience of rail and water transportation facilities, which will tend to attract future industrial development in certain directions.

In this connection it should be held in mind that the development of a system of main thoroughfares, including the widening, straightening and paving of existing streets, would greatly increase the value of property abutting on such thoroughfares. This increase in property value and utility would be enhanced still more by proper zoning and building regulation.

#### STREET DESIGN

Without going deeply into details, it is believed that certain elements entering into street design should be held in mind in order that the relation between layout and design may be evident.

Almost anyone can "design" a pavement according to so-called "standards." Such "design," however, hardly warrants the naming. It is guess work, pure and simple, and is responsible for much unnecessary



expenditure of money both in original construction and in continual maintenance. Highway engineering may not be an exact science, but at least it should approach the scientific. It is not scientific to build the same kind of pavement on residential, business and industrial streets, as is done in many cities. A pavement is not merely a wearing surface. The wearing surface takes the wear, wears out, and must be replaced.

If the pavement itself has been designed properly and constructed carefully, it should be possible to resurface it repeatedly without rebuilding the entire structure. Who would consider a bridge properly designed and built if the useful life were only the life of its floor?

Pavements must be designed in accordance with the traffic, or rather in accordance with the local weights, they have to bear. Therefore, it is necessary to know these loads weights, and they can be determined only through knowledge of the kind of vehicles and the weight of the loads to be hauled over the pavements. For purposes of structural design it is not so necessary to know the exact annual tonnage to be hauled over a pavement as it is to know the maximum live load weights to be hauled over it and the frequency with which such loads must be borne. The pavement should be designed for this maximum weight and intensity of traffic, to withstand impact and with an adequate factor of safety.

The width of a street also must be regulated according to the amount and kind of traffic to be borne. It frequently is found that some of the heaviest traffic streets are altogether too narrow for best utility. Moreover, some of these streets rightfully should not carry such heavy traffic because they do not provide the shortest and most direct routes between shipping points. This condition can be corrected by ascertaining the location of these shipping points and by laying out a system of heavy traffic thoroughfares to serve them. It would be an ill-advised expenditure of money to pave or repave, or even to resurface, all streets now bearing heavy traffic with the idea that they will continue to carry it, without first studying their location in relation to local terminal points. It also would be ill-advised to improve streets which are too narrow for heavy traffic if they properly are main thoroughfares, without first widening the paved area sufficiently to carry that traffic easily and without congestion.

Another factor to be considered in designing pavement widths is the need for parking space for automobiles and other vehicles. It is believed, however, that the parking problem is partly one of police control. Proper design of the street system should provide parking space, preferably on streets adjacent to main thoroughfares, and suitable ordinances and police control should ensure its proper use.



At this point it is desired to digress slightly from the subject of pavement design to emphasize the importance of proper regulatory laws and police control over the use of streets.

As stated in the foregoing, a main thoroughfare must be designed for heavy load weights, for intensity of heavy traffic and for impact from heavy loads. It would not be economical to design and build all pavements within the city to withstand the effects of unusually heavy loads being hauled over them. The point may be made that if this is true, residential and other light traffic streets must be in danger of destruction whenever heavy loads of building materials, coal or machinery are hauled over them. To a certain extent this is true. If such streets were economically designed, with foundations of less thickness than the customary six inches, etc., it would be more true. Hence, if a street system is to be designed and built economically, as few street systems have been, certain regulations governing the use of the streets are imperative. Loads weighing more than a specified maximum, made high enough to allow coal to be hauled to residences, should be restricted to streets designed for their use. Occasional loads of this kind should be routed by the street department; regular traffic should be required to use heavy traffic streets.

Moreover, attention is beginning to be given to the need for certain streets for slow moving and other parallel streets for fast moving traffic. This point should be given careful study in laying out and designing a street system. It may prove more economical to build two streets for different classes of traffic than one street for both. If this is true, traffic regulations would have to be prepared and enforced to ensure proper usage of the street system in this respect also. Thus it seems that traffic regulations and street design are closely related.

Other points that should be considered in designing streets are the character of the pavement surface itself and the location of subsurface structures. With the rapid increase in motor traffic, smoothness is becoming more than ever desirable in a pavement surface. The degree of smoothness has a direct effect upon the cost of transportation (because of the increase of tractive effort and of maintenance cost of vehicles and the necessarily reduced speeds of vehicles when operated on rough pavements), and the cost of cleaning and snow removal. In our northern states the latter is especially important. Streets must be kept open to traffic throughout the winter. Methods can be employed rapidly and economically to remove snow from smooth pavements, which cannot be used on rough pavements. The less noticeable but equally important and more costly work of street cleaning which must be carried on through eight or nine months of the year can also

be done much more effectively and at considerable less cost when the streets are well paved, smooth and properly maintained. These facts explain in part the tendency to use more bituminous surface pavements than formerly. Wherever this type of pavement is used, however, on a street carrying heavy traffic economy demands that a specially designed foundation be built.

The location of substructures has an important bearing on the problem of street layout and design. It has been shown that a system of main thoroughfares paved with properly designed and constructed pavements would be an economic asset to a city. But if pavements are to be built to withstand extreme traffic conditions, they are bound to be costly. Therefore to allow public utility corporations and the city's water and sewer bureaus to cut into such pavements repeatedly is a practice that should be avoided if possible. Each pavement cut means a break in the foundation—the real pavement—which cannot be repaired. There is no after construction factor which reduces the effective life of a pavement to a greater degree than pavement cuts. They can be avoided by placing all substructures in especially constructed galleries or elsewhere outside of the paved area of the street. This practice should be followed wherever expensive pavements are constructed.

#### CONCLUSION

In conclusion, it is admitted that many factors entering into the problem here discussed have not been dwelt upon. Nor have all features of design which must be taken into account been pointed out. To consider all of these points would require prohibitive space and are not believed essential to the purpose in mind. This article is written to stimulate interest in paving programs as after-the-war activities for municipalities, and to indicate in a general way the scope of the problem and the importance of viewing it largely in each case.

# THE ORGANIZATION OF A STANDARD MUNICIPAL TESTING LABORATORY

## Discussion of the Article in the March Issue

By Henry L. Howe, Jr., M. E. '10

Engineer in Charge of the Rochester Engineering Laboratory

I was very much interested in reading the excellent article published in the March number of *THE CORNELL CIVIL ENGINEER*, entitled "The Organization of a Standard Municipal Testing Laboratory." Having recently been placed in charge of the Engineering Laboratory of the City of Rochester and in this position associated with Mr. Preston, the writer of the above mentioned article, we naturally had discussed certain phases of this article. Somehow several of these points under discussion were omitted from the printed paper and I have been requested to bring these and other points out in a discussion of the article.

Mr. Preston's article will prove very valuable as a basis or plan to aid in the development of the local laboratory. It is planned to broaden out the work of this laboratory from one doing mainly engineering testing, namely the passing on cement, brick and the grading of asphalt wearing surfaces, to a laboratory capable of passing on the quality of all the materials purchased or used by the City of Rochester. It is also planned to carry out various kinds of research work, such as grease extraction from garbage and from sewage screenings, etc.

While the writer agrees with practically all of the ideas and opinions expressed by Mr. Preston, there are a few points that need to be elaborated upon to bring out their meaning more plainly. For instance, on page 54 of the article, it is believed that the statement to the effect that the practice of requiring a contractor to guarantee the work constructed by him is obsolete, is rather too broad to apply to all materials and apparatus used by a city. The principle of doing away with the guarantee period for pavements and similar construction work is no doubt sound, but in the case of city construction of a more mechanical nature, such as a hydro-electric plant, the guarantee is thought to be desirable.

A small municipality not already having a well developed laboratory in operation could not economically start a testing laboratory on such a broad scale as outlined by Mr. Preston. The logical way for such a city to develop its laboratory would be to choose an experienced civil or mechanical engineer and to give him a young chemist as an assistant and temporary quarters within convenient reach of the main engineering department office. It is believed that better results will be had by placing a municipal engineer in charge of such a laboratory in preference

to a chemist, as the former is more likely to have the broadest view of the conditions to be met with in the field; consequently he would be a much better judge of the requirements that must be met by the various materials tested. On the other hand, a chemist would be more apt to follow exactly the standard procedure necessary in testing materials and would be likely to obtain more accurate results for purposes of comparison with similar materials. The staff organization described by Mr. Preston then could be developed from this nucleus.

At the start with a smaller laboratory, the samples could be collected, for routine work, by the director or his assistant, who should be supplied with an automobile to expedite the collection. When the material can be sampled only at intermediate intervals, as an asphalt surface mixture for example, the asphalt plant inspector might be entrusted with the duty of obtaining the samples to be held for the collector. In such a case, however, the samples should be occasionally obtained under the supervision of a representative of the laboratory.

Contrary to the opinion expressed by Mr. Preston, that it is not economical to equip a laboratory with tools, etc., for making minor repairs to apparatus, the writer believes that much time frequently can be saved by having a small lathe, work bench and an assortment of tools available for use by the laboratory personnel. However, if such a shop is located in the laboratory, it should not become a general repair shop for the entire city or even for the entire engineering department.

When the laboratory expands sufficiently it is suggested that space be allotted for a museum. Samples of various types of materials, cross-sections of actual pavements, etc., when properly selected and labeled form an excellent exhibit to show contractors and others those materials that are and are not acceptable. Such an exhibit would also form the basis of comparison for the laboratory staff as standards in judging other samples.

In connection with this museum, space should be allotted for the storage of samples of materials such as asphalt cements, etc., used in actual construction. These would be available in cases of disputes resulting from damage to pavements from gas leaks, etc., and would protect the laboratory in cases where good materials have been improperly used in the field.

On page 63 of the article, Mr. Preston quotes from the new specifications for local improvements. This clause has been slightly modified so as to require a submission of samples by a "material arrangement" whereby the contractor apparently submitting the lowest bid, upon notification, makes arrangements with the laboratory before the contract can be awarded. While accomplishing the desired purpose, this change



will lighten the work of the laboratory by reducing the number of contractors otherwise involved.

Under the heading "Utilization of Results" Mr. Preston states that the policy of the laboratory should be to give preference whenever practical on the basis of relative quality, rather than to test materials with the view of their passing only the minimum requirements of the specifications. This policy has been followed by the City of Rochester in recent years in purchasing coal. Bids on coal have been compared and contracts made, not as in the past on the price per ton basis, but on the basis of the price per million heat units on the coal offered, corrected for moisture and ash. The coal actually delivered on the contract is checked up for quality by laboratory analysis and the bid price adjusted according to the actual quality of the coal supplied. These coal specifications have proved to be very satisfactory and make it possible for the city to buy "energy" rather than merely "coal." They also make it possible for a contractor having a high grade of coal to bid in fair competition with a contractor having a cheaper or rather lower grade of coal. This was not possible under the usual system of letting the contract on the price per ton basis. This policy of letting contract and paying for materials on the quality basis is possible of extension and has considerable advantages to both the city and to reliable contractors. It is also applicable to "cost-plus" contracts.

As pointed out by Mr. Preston, the testing work should be carried out in sufficient detail not only to see that the materials in question comply with the specifications under which they are purchased but their characteristics should be accurately determined and complete reports filed away for future references. In this manner the data will always be available in the laboratory on which to base future specifications. It is believed by the writer that one of the main duties of the testing laboratory is to keep the specifications for materials up to date; getting rid of unfair and obsolete requirements and practice.

It is absolutely necessary that the results of all tests on materials and recommendations for their use be given out promptly by the laboratory. If the work of construction is delayed because the laboratory does not properly plan its work or if it allows unnecessary detailed refinements of testing to interfere with the contractor's plans, the work of construction will go on in spite of the desired laboratory reports. Thus the purpose of the laboratory will be defeated.



## OBITUARIES

**Mervale Dalton Makepeace, C. E., Class of 1875**

Died at Syracuse, N. Y., July 14, 1916.

Mervale D. Makepeace was born at Pamela, Jefferson County, New York, on July 18, 1849. He attended the Watertown High School and entered the course in Architecture at Cornell in 1871. He transferred to Civil Engineering and took the degree of B.C.E. in 1875 and that of C.E. was conferred on him in 1890. He was a member of the Beta Theta Pi.

After graduation Mr. Makepeace worked for the U. S. government about a year on the Mississippi River, but contracted a severe case of malaria in the swamps below St. Louis and was unable to go back to engineering work. He returned to Watertown and worked in an architect's office for about six months, after which he opened an office in Auburn, N. Y. In 1879 he took some additional work in the university and in 1894 he moved to Syracuse where he practiced architecture until his death, on July 14, 1916, which resulted from injuries received in a fall from a cherry tree at his home. He is survived by his widow, Mrs. Lila (Macomber) Makepeace, a student in the university in 1874-75, one son, Stanley Makepeace of Detroit, and one daughter, Mrs. Floyd F. Decker of Syracuse.

Among the buildings designed and built under his supervision are The Onondaga County Penitentiary, The County Morgue, Sumner School, St. John's School and various banks, schools and churches in Syracuse, Auburn, Skaneateles, Manlius and Solvay.

**Raymond Schlegel, C. E., Class of 1911**

Died at Baltimore, Md., October 6, 1918

Raymond Schlegel of Baltimore, Md., was born on June 10, 1888 and graduated from the Baltimore Polytechnic Institute in 1908. He entered the College of Civil Engineering in the Fall of that year and received the degree of C.E. in 1911.

After graduation he worked in the Bridge Department of the B. & O. R. R., taking at the same time the course in Law at the University of Maryland, which enabled him to pass the State bar examination.

In 1916 he entered the employ of the Consolidated Engineering Company, Inc., of Baltimore, as Engineer and Estimator. During 1917 he was chief assistant to John A. Stalfort, C.E., 1910, General Manager of the Building Department of that company, on the construction of Camp Greene at Charlotte, N. C. He died of pneumonia on October 6, 1918, after only a week's illness.

# THE CORNELL CIVIL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR BY

The Association of Civil Engineers of Cornell University  
Ithaca, N. Y.

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## EDITORIALS

### The Cornell Civil Engineer

During the last weeks of the school term much time and energy were spent in making ready for the Semi-Centennial Celebration. THE CIVIL ENGINEER did its share along this line by concentrating its efforts on the June issue which came out during the above celebration. This issue, known as "The Semi-Centennial Number," contained the entire list of Civil Engineering graduates up to and including June, 1919.

As the May issue was delayed due to this reason, it was decided to hold it over still longer and have it contain the report of The College Conference held at the time of the celebration. THE CIVIL ENGINEER regrets the tardiness of the May issue but hopes the report of the conference will enlighten many alumni on the present status of the Civil Engineering College.

**Effect of  
Bridge Piers  
on Flow of  
Water**

It has recently been proposed to replace the present steel bridge over the Chemung River at Main Street, Elmira, with a modern concrete arch bridge.

The determination of the feasibility of the new structure is an interesting problem in the change of water level due to additional obstruction offered by the piers and arches. A discussion of the problem, is given on page 119 of this issue by Professor S. G. George and E. W. Rettger, which considers the probability of the recurrence of such a flood, as that which occurred in June 1889, and the backwater that would be produced by the arches and piers of the new bridge under conditions of probable maximum flood.

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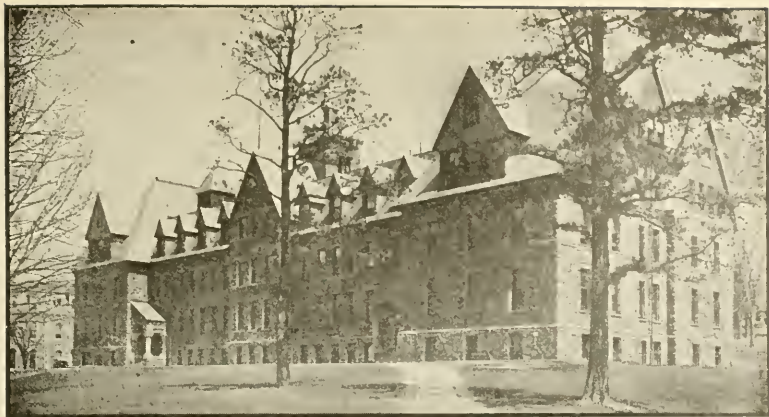
Study well the English language and obtain a thorough command of it, in order that you may be able to speak and write it with conciseness and vigor. Perfect yourself in style by reading well written books, even if they come under the denomination of light literature. A little of the latter affords relaxation, and when really good, can do no harm to a professional man, unless he becomes so addicted to its perusal as to neglect more important reading.—*Waddell*.

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Every engineer who has any literary gift whatsoever should cherish the ambition to write a technical book. Good technical books are needed today, and will always be in demand. Their lives are of necessity short, as practice is constantly changing; but the fundamental principles of design and construction never change; therefore he who deals with these in his writings will produce books that will continue to be useful perhaps long after he has passed away.—*Waddell*.

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In many lines of work it is just as important to know what has already been done as it is to possess great ability to originate new designs, and as between the man who is an expert designer in any department of engineering and the one who has the faculty of utilizing the work of many other men in many departments, the latter will be the more valuable man, will be more sought after, and will rise higher in his profession. In other words, it is not so much what a man can do himself as what he can get others to do that makes him valuable in carrying on large undertakings.—*Kennedy*.



## COLLEGE NOTES

### The College Conference

The College Conference of the College of Civil Engineering held on June 20th, as a part of the Semi-Centennial Celebration, and presided over by Professor I. P. Church, was successful in its object of bringing a large number of graduates together and rendering a service to Cornell, by the discussion of the needs of the College of Civil Engineering to make its curriculum conform to the needs of engineering education.

The entire reports of the "visiting alumni," viz.: Messrs. J. A. Knighton, 1891; I. W. McConnell, 1897; R. F. Proctor, 1901; and E. B. Whitman, 1901; are worthy of being published for the benefit of those who were unable to attend the conference, but space permits only the quoting of extracts from each of the reports.

The following paragraphs are quoted from Mr. Knighton's report on "Some Phases of Engineering Education:"

"The wise planning of a curriculum requires a knowledge of present conditions, and a vision of the future that is undimmed by either precedent or fad. I shall not attempt it here, but merely call attention to some of the features which I believe to be essential in the regular course in Civil Engineering at Cornell University.

In my judgment the course should be liberal in character, with some work in mechanical and electrical engineering, including shop work.

The time may come when such a course should be five or more years in length; but for the present I would recommend no change from the present four years' course. In a course of that length we cannot produce specialists, we can only build the foundation. Cornell is and should be prepared to train specialists, but such training should come after the

regular course and be taken by those who have a very definite idea of their life work.

I think that most of you will agree with me that there should be a thorough grounding in the fundamentals. By fundamentals I mean such tools of the engineer as: Mathematics, Mechanics, and Physics, which do not change with the years, no matter what changes may take place in engineering practice.

English both oral and written should have a prominent place in the course. Professor Fuertes used to say that the Engineer should be able to stand on his hind legs and talk.

Engineering practice is constantly changing. The student must be made to realize this. Problems should be assigned to him of such character that it will be necessary for him to make his own assumptions and draw his own conclusions. His time should not be so filled with absorbing facts and conclusions arrived at by others that he has no time to think.

Today trade and technical schools are training students in surveying and drawing, and it would appear that the time is ripe to recognize that as their field; and to hold a higher conception of the aim of Civil Engineering Education at Cornell.

After all, the inspiration of the teacher counts for so much that the curriculum pales in comparison. Cornell owes her greatness today, to the lives of such men as Fuertes, Crandall, and Church, and with their ideals perpetuated, the School of Civil Engineering and the University can confidently look forward to the future."

Extracts from Mr. McConnell's complete and very thorough report are presented below:

"The first weak spot which I have found in new graduates is the inability to apply accurately and quickly their theoretical knowledge to the work which comes to them. It is as though one groped in a familiar forest to find fagots for a camp fire, and too frequently in the early years the seeker emerges with some ponderous intellectual process for a simple problem which in turn resembles bringing out a sawlog for the fire instead of the twigs that lie about. I believe however that the difficulty can be reduced by thorough work. I never have known a student who was thoroughly grounded in mechanics who had much trouble with technical problems in practice.

Confidence in so-called practical courses seems to me doomed to disappointment. Engineering practice, in the main, is a tedious repetition of relatively few principles coupled with much study of the economics of the situation.



The second weak spot which I have noticed in the new graduate is inability to set up in a clear and logical way any proposition which he wishes to demonstrate. A large part of this inability I ascribe to that lack of thoroughness previously discussed. A part of this lack of clear expression is due to lack of acquaintance with the English language. 'Grand writings' have no place in engineering compositions. The engineer who finds out how to put all his ideas in words of one syllable will be the model.

The third weak spot is the inability of the new graduate to apply checks to his work so as to assure himself that it is accurate and constitutes at least one complete answer to his problem.

A fourth weak spot is the inability of engineers to comprehend and interpret balance sheets, fiscal statements, operating accounts, etc. A brief course in corporation and general accounting would help the situation.

A fifth weak spot is impatience and disregard on the part of engineers of their legal and political limitations, duties and privileges. Well devised courses in contract law, social science, psychology and business management would open up many interesting vistas along these lines.

I call attention to the list of subjects which I have suggested for addition and for convenience shall refer to them hereafter under the general title of 'Desirable Additions:' Machine Design, Applications of Mathematics and Mechanics, Shop Practices and Shop Production, Exercises in Accurate Composition, Theory of Accounting, Cost Keeping, Corporation Accounts, Bills of Materials and Estimates, Psychology, Social Science, Business Management, Contract Law, and Modern Languages, in all amounting to about 23 hours.

It seems to me, then, that we are in shape to consider several, partially alternative propositions, to wit:

1. Can Cornell afford to make the required course for the degree of Civil Engineer five years instead of four, adding to the present requirements the list called 'Desirable Additions?'

2. Is it feasible to eliminate the 18 hours elective in the present course and insert in lieu thereof the 'Desirable Additions' in the requirements of a four year course leading to a degree?

3. Is it feasible to operate the University on the basis of a scholastic year of eleven months instead of nine? If it is feasible the 'Desirable Additions' can be added to the present four year course and be completed in four calendar years. I see no reason why students should lose three months every year. Financial reasons on the part of the University and on the part of the students may make the suggestion impractical.

4. Can the present four year course, slightly abridged, be given in a three-year eleven-month term?

5. Is the following procedure practical?

Lay out a course consisting of all the subjects of the present course except those classified as 'Applied Civil Engineering'. Add to it the subjects called 'Desirable Additions'. The total will be 125 hours. Give it in three years of nine months each. It will be a stiff course, but men who cannot make it will do well to wonder if they belong in the engineering business. Grant for this not a degree, but a certificate of attendance at the completion of the course. Leave the present four year, five year and six year courses as they are with provisions as heretofore indicated for the inclusion of the 'Desirable Additions' and grant the degrees now conferred for the completion of those courses.

I believe proposal 5, for a three year course, will meet the needs of the rank and file of Cornell civil engineers. It will not give that broader culture and wider knowledge of engineering which I have always envied in other men and which I wish every engineer could have but this broader training would take six years in college and I do not believe we can face that demand yet. I do not believe the three year course represents lowering standards nor cheapening the degree provided there is an insistence upon thorough work.

I consider suggestion No. 1 inadvisable.

I consider suggestion No. 2 feasible.

Suggestions 3 and 4 involve sweeping changes in university policy which I do not feel competent to discuss.

Suggestion 5 I believe to be worthy of thorough study by faculty and trustees who must ultimately make the decision in any event.

I cannot leave this subject without reference to the faculty, and in this connection my remarks are addressed solely to the alumni. The Faculty in the College of Civil Engineering at Cornell display today, in my judgment, the same conscientious devotion to duty displayed by the members of the various faculties with which we were acquainted as students. I express the opinion that the most conspicuous service which the alumni of this institution can offer is an organized effort to bring the members of the faculty into contact with engineering practice and keep them definitely in touch. As a practical matter, I see no way to bring this about except for the various concerns which are headed by Cornell men to take on a certain periodic obligation whereby members of the staff at Cornell are invited to the work, given an opportunity to look into it—not merely in its external appearances, but as to the interesting details by which processes are set on foot and maintained."

The following is an abstract of the report of Mr. Proctor:

"The civil engineering course should be highly specialized, maintaining a high standard in courses offered; in addition, as much English, Public Speaking, Business Contracts, and Specifications should be given as time permits. The college of Civil Engineering should design these latter courses to fit the needs of engineers, and should design the entire course not only to make engineers but also to prepare them for marketing their engineering ability. The college should encourage State and commercial concerns to use its equipment and facilities for engineering investigations, reports, and testing of raw and manufactured engineering materials."

Note. Both Mr. Clark and Mr. Whitman were prevented from coming to Ithaca, as "visiting alumni."

It was planned that after the reading of the reports of the "visiting alumni," discussion would be opened on the topics and recommendations brought out, and also on special topics connected with the work of the college, but time did not permit as wide a discussion as was originally planned.

Colonel Henry R. Lordly, '93, in a discussion of the reports and special topics may be quoted as follows:

"The papers that we have listened to I think are noted, but I will admit do not solve the problem from the standpoint of a man who has been away from his Alma Mater, like the speaker, for twenty-five years.

I am not an old man, but am old in experience, and I do not forget the words which Professor Fuertes gave me when I entered the old building in 1889. He said this: 'We do not pretend to make engineers here. We can give you a fundamental training whereby if you have the makeup you may become an engineer, but we cannot make you such.'

To comment briefly on the remarks made by these gentlemen who have so kindly studied your curriculum, it would appear that to lessen the course here, to give a man some kind of a certificate, whereby he could go out into the world and state that he came from Cornell University after three years training would be a crime against the institution and against its faculty. You could not take, from my experience, the brightest youth that ever lived and pass him thru this institution and put him out to be anything better than a common laborer if you limit his time to three years.

I believe your best problem today is to maintain the standing of this college, not by headings to your curriculum and syllabus, but by the name of the professor who stands for the heading of that curriculum.

Let me answer for you from my training and experience the following questions:

1. What features of the curriculum have graduates found most helpful in their work since leaving college, and what additional features or substitutions would they have been glad to have?

Personally, I have found no deficiencies in the curriculum, any deficiencies that existed were in the man who walked out of here with the degree in his hands and who perhaps got through with a very low pass. These deficiencies will soon be found out by the graduate and it is his duty to correct them. The writing of specifications, letters, etc., and presenting them in good form can only be obtained by practise, but I myself gained most of my knowledge by instruction from Professor Church when he taught us to make our reports, etc., in accurate and neat form.

2. Influence of war experience on future teaching of civil engineering.

I speak only as one who has had a good many years of experience in military engineering, five years of almost constant military service including three years of constant experience overseas, and my experience with military engineering is to get through in the shortest possible time, regardless of cost or expense or any sacrifice. Now you gentlemen know that you can't do that in civil life. So personally, I believe that beyond the ability of quickness, thinking quick, acting quick, getting material together quickly, in the rapid instruction of men as with military engineering there is nothing to be gained by a military education as it concerns the curriculum of this college.

5. The Art of Dealing with Men; and whether anything might be done in the curriculum to inculcate or develop this art.

This subject is something that cannot be taught here. I know from actual experience in handling men from Russians, Italians and all kinds of aliens down to the Britisher from the north of England that tact is the sole requisite. You must take your men and your foreman and study them up, be a friend to the man you employ, don't antagonize him, take to him warmly, go out of your way to work his heart, but do not antagonize him. There is nothing in this course in the university that will help you in this respect, it requires tact, and you can't learn that in a university course. Tell that man working for you that what you want him to do is of interest not only to you but for himself."

## ALUMNI NOTES

'73. Frederick J. Knight is a computer on the International Boundary Commission, 719 15th Street N. W., Washington, D. C.

'74. Charles Hamilton Lay of Oil City, Pa., has retired from business.

'78. Cornelius S. Thacher has retired and is living at Clifton Springs, N. Y. He says that he is devoting his time to his garden, to reading, to recreation and to the art of growing old gracefully. He has taught mathematics for 35 years in high and technical schools.

'88. J. H. Edwards is Assistant Chief Engineer of the American Bridge Company, 30 Church Street, New York, N. Y.

'91. J. W. Beardsley is Assistant Chief Engineer, Grand Canal Improvement Board, Tientsin, China. His home address is Heights Courts Apartments, Ithaca, N. Y.

'92. John P. P. Lathrop of Wayne, Pa., is a Civil Engineer and Contractor in Landscaping at Overbrook, Pa.

'93. Charles W. Ashby is Charge Man, U. S. Naval Station, Newport News, Va. His address is Box 190 R. F. D. No. 4, Hampton, Va.

'93. H. K. Bishop is District Engineer, U. S. Bureau of Public Roads, Department of Agriculture. He lives at 2001 16th Street, N. W. Washington, D. C.

'93. H. R. Lordly was Lieutenant-Colonel in the Canadian Expeditionary Force. He has just returned from three years war service in Great Britain and is now a Consulting Engineer at 74 Strathearn Ave., Montreal, West P. Q., Can.

'92. John B. MacHarg of Rome, N. Y., is in the Department of History, Lawrence College, Appleton, Wis.

'94. Thomas B. Bryson is a Contractor at 52 Vanderbilt Ave., New York, N. Y.

'94. H. W. Strong is Secretary of The Strong, Carlisle & Hammond, Cleveland, O. His address is 1939 E. 90th Street.

'95. Norman B. Livermore of San Francisco, Calif., is President of the N. B. Livermore & Co., Pacific Car & Equipment Co., and Vice-President of the Northwestern Equipment Co. He recently returned from fourteen months service in France as Major of Engineers, U. S. A.

'95. M. S. MacDiarmid of 157 Colorado Ave., Detroit, Mich. is U. S. Assistant Engineer of the U. S. Lake Survey, located at 211 Old Custom House.



'95. Danly D. Sprague is Structural Engineer in the Valuation Department of the Interstate Commerce Commission. His office address is Wells Fargo Building, San Francisco, California. He is living at 1131 Balboa Street.

'96. Joseph C. Hilton of 1918 Cortelyou Road, Brooklyn, N. Y., is engaged in contracting with the Mason, Hilton & Co., located at 120 Liberty Street, New York City.

'97. I. W. McConnell is Vice-President of Dwight P. Robinson & Co., Inc., 61 Broadway, New York City.

'98. Charles B. Hobart is Resident Manager of a dye woods, hard woods, and chewing gum plantation in Mexico. His home address is 105 North Wissahickon Ave., Ventnor, N. J.

'98. Edgar Johnston, 733 Park Avenue, East Orange, N. J., is Secretary and Treasurer of Oakwood Ice Co., 26 Oakwood Avenue.

'99. Frank L. Getman is General Manager of the Getman Commercial Co., Manufacturer's Representatives, and President of the Cuban Importing Co. Offices Lonja 518, Havana, Cuba. His residence is, Calle 8, No. 19 Vedado, Havana, Cuba. He reports that Malcom Rue, C.E. '99, is in Cuba with the American Steel Company.

'99. Elijah H. Owen of 390 Lawrence Ave., Detroit, Mich., is a Captain of Engineers, with the 5th Engineers at Camp Humphreys, Va. He expected his discharge about May 15.

'99. Malcolm A. Rue is with the American Sheet Metal Company, and is living at 49 Lenia, Havana, Cuba.

'01. Arthur Adams is a Lieutenant-Colonel in the Ordnance Department, U. S. A. and is stationed in New York City at present. He lives at 421-A Lafayette Avenue, Brooklyn, N. Y.

'01. Irving C. Brower, of 12 9th Street, S. E., Washington, D. C., is a Major in the Construction Division. He is in charge of the Road and Railroad Section, Maintenance and Repair Branch.

'01. L. J. Houston, Jr., of 608 Parkwyth Avenue, Baltimore, Md., is City Manager for Fredericksburg, Va.

'01. C. W. J. Neville is a Lieutenant-Commander U. S. N. R. F. He has been in active service in the U. S. Navy since March 28, 1917. His home address is 2226 Canal Street, New Orleans, La.

'01. Herbert S. Wilgus is a Consulting Engineer at Angelica, N. Y. He was recently honorably discharged as a Major in the U. S. Army.

'02. George M. Forrest is General Superintendent for the Ingersoll Rand Company, at Phillipsburg, N. J. and at Easton, Pa. His home address is 129 Pierce Street, Easton, Pa.

'03. Ernest Brooks is a partner in the firm of Starrett & Van Vleck, Architects, 8 West 40th Street, New York City. His home is in Cedarhurst, N. Y.

'03. John H. Lewis is Engineer-Manager, Warm Springs Irrigation District, Vale, Oregon.

'03. Thomas D. Newman is a Captain of Engineers, 15th Company, 14th Grand Division, A. E. F. His address is A. P. O. 718 France. His permanent address is 406 Lexington Street, Auburndale, Mass.

'04. Newton C. Fassett was discharged from the army on April 26th, 1919. His address is now 240 Waverly Place, New York City.

'04. Arthur K. Shumway of 44 Electric Ave., Rochester, N. Y., is Engineering Contractor on reinforced concrete construction at Rochester.

'05. Joseph A. Boorstein, living at 337 82d Street, Brooklyn, N. Y., is Assistant Engineer, Engineering Division, Department of Finance, New York City.

'05. Harold F. Hamlin is Cuba Manager for The Sugar Products Co., P. O. Box 1192, Havana, Cuba. He was discharged December 5, 1918 at Camp Humphreys, Va., as Captain of Engineers. Orders were received to go to France November 11th, the day the armistice was signed, but the orders were cancelled the following day.

'05. Melvin Rich lives at 1448 Harvard Street, N. W. Washington, D. C. He is engaged in Structural Engineering at 1410 H Street, N. W. Washington, D. C.

'06. G. L. Bilderbeck is President of Bilderbeck & Langdon Inc., New London, Conn., Architects and Engineers. He lives at Groton, Conn.

'06. John J. Klaber, 1st Lieut. Engineers, has recently returned from France after ten months in railroad service of the A. E. F. He is now under treatment at General Hospital 41, and is awaiting discharge.

'06. L. S. Rickard, residing at Elsmere, N. Y., is Assistant Civil Engineer, Department of State Engineer and Surveyor.

'06. Seth W. Webb is Office Engineer of the New York Central R. R. at Cleveland, Ohio. His home is at 4146 E. 106th Street, Cleveland, Ohio.

'07. Gordon B. Canaga is Head of the Designing Section of the Shipyard Plants, Emergency Fleet Corporation, Philadelphia, Pa.

'07. Laurence J. Conger is Sales Manager of the Corona Typewriter Company, Groton, N. Y.

'07. Joseph Gallagher is in the U. S. Engineers Office at Charleston, S. C.

'07. Carl A. Gould is a Contractor and Engineer specializing in Hydraulic work. His address is 512 Delaware Street, S. E., Minneapolis, Minn.

'07. David E. Hannan of 4446 Drexel Blvd., Chicago, Ill., is not located as yet. He recently resigned a commission as Captain of Tank Corps.

'07. Antonio Lazo is a member of the firm of Bodell & Company, Investment Brokers, 120 Broadway, New York City. His address is 108 East 82d Street, New York City.

'07. Charles Wells Linsley is Engineer of the Oswego Candy Works and Long's Chocolate Works at Oswego, New York.

'07. Chas. H. Mallison is Engineer of Erection for the McClintic Marshall Company. His residence is at 1012 High Street, Pottstown Pa.

'07. H. A. Patten is farming at New Bern, N. C.

'07. Louis J. Sieling is a Contracting Engineer located at Red Bank, N. J. He can be addressed at 211 Broad Street.

'07. Clarence L. Todd is Contracting Engineer and Manager of the Washington office for the Pittsburgh-Des Moines Steel Co., Munsey Bldg., Washington, D. C. His residence is 1111 Harvard Street, N. W.

'08. Philip B. Hoge of Philadelphia is with C. E. Knoeppel & Co., Inc., 6 E. 39th Street, New York City. He is assigned to work in various parts of the country as assistant on investigations and reports on factory operation, management, and cost accounting systems. A daughter was born to Mr. and Mrs. Hoge March 12, 1919, at Philadelphia, Pa.

'08. H. Kehoe of Oswego, N. Y., is City Engineer.

'08. R. A. Smallman is Captain, Co. F, 25th Engineers, Brest, France, A. E. F. His home address is care of Smallman-Brice Co., Birmingham, Ala.

'08. Harry K. Wilson is a Captain with the 510th Engineering Service Battalion at Guer, Morbihan, France, A. P. O. 711. His permanent address is 1912 E. Taylor Street, Bloomington, Ill.

'09. Charles Clark is with the Kansas City Structural Steel Co. His home address is 1247 Metropolitan Ave., Kansas City, Kansas.

'09. Robert W. Clark is General Superintendent in charge of the construction of 7500 ton reinforced concrete tankers for the Fred T. Ley & Co., Inc., at Mobile, Ala. His address is 1288 Government St.

'09. G. D. Curtis is Manager of the Morris Plan Bank of Tampa, 814 Florida Ave., Tampa, Fla. He announces a "young Cornellian" was born March 19, 1918, G. D. C., Jr.

'09. R. M. DeGarmo who was a Major in the 17th U. S. Engineers in France is now located at Cocanut Grove, Florida.

'09. A. Clinton Decker was recently elected Mayor of the city of Fairfield, Alabama.

'09. Robert L. Fox is City Engineer of Bethlehem, Pa. He can be reached at 38 Ave. F, North Bethlehem, Pa.

'09. Arthur W. Harrington is a 1st Lieutenant, Sanitary Corps, U. S. A. His permanent address is 176 Palisade Ave., Yonkers, N. Y. He reports that a second son, A. W. H., Jr., was born on January 13, 1919.

'09. John R. Haswell gives 402 Delaware Ave., Wilmington, Del., as his permanent address. He is Senior Drainage Engineer, Bureau of Public Roads, headquarters, Washington, D. C. He was honorably discharged as Captain of Engineers on March 18, 1919. He recently returned from France with the 317th Engineers where he commanded Company "F".

'09. Herbert E. Hayes is Engineering Examiner, State Civil Service Commission, Albany, N. Y. He lives at 39 New Scotland Ave., Albany, N. Y.

'09. Thomas Martin is in the Navy Yard at Philadelphia, Pa. His residence is 112 Powelton Ave., Lansdowne, Pa.

'09. R. Y. Thatcher of 34 Wellington Road, Buffalo, N. Y. is a Civil Engineer at the Lackawanna Steel Plant.

'09. George F. Wiegardt is Highway Engineer of the city of Baltimore with offices in the City Hall. He is also a member of the Board of Estimates and the Controlling Board of the city. His address is 3210 Walbrook Avenue.

'10. I. Ellis Behrman has just been appointed a Major in the A. E. F. and is located at Neuf Chateau, France. His home address is 1121 E. Baltimore Street, Baltimore, Md.

'10. Clement E. Chase is in charge of the New York office of Ralph Modjeski, Civil Engineer, 101 Park Ave., New York City. He lives at 52 Brookside Drive, Larchmont Gardens, Larchmont, N. Y.

'10. Wilmer A. Dehuff is now Head of the Department of Engineering at the Baltimore Polytechnic Institute. His address is 2034 E. 30th Street, Baltimore, Md.

'10. S. E. Dockstader of Fonda, N. Y., is Construction Engineer for the American District Steam Co., North Tonawanda, N. Y.

'10. Thomas Dransfield, Jr., has changed his address from 364 Barton Street, Rochester, N. Y. to 8542 Westchester Park, Philadelphia, Pa.

'10. C. G. Holmquist was discharged from the army as Captain in the Heavy Artillery. He is now with the Chile Exploration Company. His residence is 47 West 49th Street, New York City.

'10. A. Craig Meikle is 1st Lieutenant, Co. "F" 304th Engineers, 79th Division, France. His home address is 3115 Clifton Ave., Baltimore, Md.

'10. Harold J. Spelman is Division Engineer, State Road Commission, Huntington, W. Va. He lives at 107 11th Ave., west.

'10. W. L. Squire is Manager of the Purchase and Order Department of the U. S. Light and Heat Corporation, Niagara Falls, N. Y. His address is 2902 Main Street, Niagara Falls, N. Y.

'10. O. S. Van de Mark located at 410 Gulf Building, Houston, Texas, is Vice-President of the American Construction Company, of Houston, Texas. On February 15, 1919 he was honorably discharged as Captain in the U. S. Air Service.

'11 A.B. '13 C.È. Herbert Ashton is in the 38th Company, 20th Engineers, A. E. F., France. At present he is in a detachment studying at the University of Grenoble, France.

'11. Frank H. Branin of 34 So. 10th St., Newark, N. J., is Factory Manager of the Buttrick Publishing Company, 64 W. 23d Street, New York City.

'11. Major Walter L. Conwell, 307th F. A., Assistant Professor of Highway Engineering, is Superintendent of Buildings and Grounds at the A. E. F. University at Beaune, France.

'11. A. J. Fancher is now living at 2203 Ditmas Ave., Brooklyn, N. Y. He is a Telephone Engineer with the New York Telephone Company, 81 Willoughby Street.



'11. Ralph S. Crossman is Assistant Professor of Civil Engineering at Clemson College, South Carolina.

'11. George S. Frank is a Captain, U. S. A. with the American Food Administration, Paris, France.

'11. Samuel A. Graham has just returned from 15 months overseas service with the 25th Engineers as a Captain. R. R. Smallman, '08, and J. McL. Demarest, '13, were also with the 25th Engineers. Mr. Graham is living at 63 West 96th Street, New York City.

'11. William G. Hoyt is a Civil Engineer in the Hydrographic Division of the U. S. Geological Survey located at Madison, Wis. His address is 12 Lathrop Street, Masidon, Wis.

'11. Robert L. H. Tate of 219 Linden Ave., Ithaca, N. Y. is a Captain of Engineers, U. S. Army, 7th Division, American Expeditionary Forces.

'12. Robert W. Austin of 612 Myrtle Ave., Albany, N. Y., is an assistant to the Adjutant General at the American Expeditionary Forces Headquarters, Paris, France.

'12. John W. Brown is Assistant Engineer with the McClintic-Marshall Company, Pittsburgh, Pa. He was recently discharged from the 36th C. A. C. He lives at 1226 8th Ave., Beaver Falls, Pa.

'12. George P. Buchanan of 6113 Howe Street, Pittsburgh, Pa., is General Sales Agent for the H. J. Heinz Company. On April 3, 1919, he was honorably discharged from the U. S. Army.

'12. John D. Burrage is in the Cost Department of the Turner Construction Company. His home is at 111 Cray Ave., Mt. Vernon, N. Y.

'12. John T. Child of 194 Oxford Street, Rochester, N. Y., was honorably discharged on January 25, 1919 at Camp Meade, Md., as a 1st Lieutenant in the Sanitary Corps. He is now Assistant Engineer in the Rochester Bureau of Municipal Research, 501 Arlington Bldg., Rochester, N. Y.

'12. James E. Cuff of 145 Flower Ave., Watertown, N. Y., is Assistant Engineer, New York State Highway Commission, Syracuse, N. Y.

'12. M. A. Darville is Office Manager of the Construction Department of the Turner Construction Company, 244 Madison Ave., New York City. After having served in France for nine months he was honorably discharged from the U. S. Army as a Lieutenant of Engineers. His home address is 549 Decatur St., Brooklyn, N. Y.

'12. Elmer Heubeck is an engineer with the Pennsylvania Water and Power Company, Room 611 Lexington Building, Baltimore, Md. His address is 3440 Auchentoroly Terrace. Recently he was honorably discharged as a Captain of Engineers, U. S. A.

'12. Hollister Johnson of Dryden, N. Y., is Captain of 116th Engineers, 40th Div., A. E. F., France.

'12. Edward H. Leggett is a First Lieutenant in the 307th Machine Gun Battalion, 78th Division, A. E. F. He commanded his company in the Argonne Forest. At present he is on leave and taking a three months post-graduate course in French Literature and Language at Sorbonne University, Paris. He expects to return to the U. S. about July 15th, 1919. His home address is 8 South Allen Street, Albany, N. Y.

'12. H. D. Ogelsby is an Engineer in the State Highway Department at Erie, Pa. His home address is 31 Front Street, Harrisburg, Pa.

'12. Albert C. Rountree is a First Lieutenant, Coast Artillery, Fort Monroe, Va. His home is in Quitman, Ga.

'12. John J. Stahl is Highway Engineer, Bureau of Public Roads, Department of Agriculture, 301 Custom House Building, Denver, Col.

'12. A. K. Starkweather is an Engineer with the New York Telephone Company, at 15 Dey Street, New York City. His home address is 147 South Elliott Place, Brooklyn, N. Y.

'13. Arthur W. Beale is a building contractor. His home address is 240 Rutgers St., Rochester, N. Y.

'13. E. D. Burkhart, of 482 Delaware Ave., Albany, N. Y., is Inspector of Grade Crossings, Public Service Commission, Second District, Albany.

'13. Floyd E. Burton has changed his address from 1607 Gilpin Street to 1648 Washington Street. He is a junior partner with the Burton Seed and Produce Company.

'13. Francis Murray Dawson is Captain of Canadian Engineers. He saw service four years with the Canadian Expeditionary Force as Adjutant, Engineers Battalion. He won the Military Cross and was also mentioned in dispatches. He is located at Truro, N. S., Canada.

'13. Isadore J. Elkind is Assistant Engineer for S. Blickman, 199 Lafayette Street, New York City. His home address is 117 Saratoga Ave., Yonkers, N. Y.

'13. H. W. Fear on February 1, 1919, resigned his position of Assistant Engineer in the U. S. Geological Survey to become a member of the firm of Fear & White, glove manufacturers, Gloversville, N. Y.

'13. Thomas J. Fleming is a Lieutenant in the 543d Engineers of the A. E. F., stationed at Charmont, France. His home address is 29 Beacon Street, Waterbury, Conn.

'13. Jesse C. Johnson is a merchant located at Lamar, Colo.

'13. Edwin F. Koester is Engineer in Charge of the Surveying Department, City of Wilmington, Del. His address is 807 West Street.

'13. Harvey T. Munn is Assistant to Chief Engineer, U. S. Housing Corporation, Department of Labor, 613 G Street, N. W., Washington, D. C. He resides at 1833 S Street, N. W.

'13. Blinn S. Page of 424 Burlingame Ave., Detroit, Mich., is a Salesman for the Carnegie Steel Company, 1815 Ford Bldg. He was honorably discharged from the Inspection Division, Ordnance Department after one and one-half years' service.

'13. Roger W. Parkhurst has changed his address from 62 Montague Street to 210 St. Johns Place, Brooklyn, N. Y.

'13. Robert S. Wait was discharged as First Lieutenant 301st F. A. on January 22, 1919. He has been reinstated in his former position of City Engineer, Norwich, N. Y. He lives at 187 N. Broad Street.

'13. Russell D. Welsh is Lieutenant of Engineers stationed in France. His home address is 721 Reservoir Street, Baltimore, Md.

'14. Ethan F. Ball entered the service in June 1917 as a 2d Lieutenant of Engineers, was promoted to 1st Lieutenant in July 1918, and was honorably discharged on December 20, 1918. He is now Assistant Engineer for the McClintic-Marshall Company, at Pittsburgh, Pa. His residence is at 7127 Race Street, Pittsburgh, Pa.

'14. L. M. Brooks, living at 261 Robert Street, Baltimore, Md., is Vice-President of the Electromechanical Co., 530 N. Calvert Street.

'14. Frederic W. Conant is a Captain of Engineers. He is with the 9th Engineers (mounted) stationed at El Paso, Texas.

'14. J. G. C. Christie is a member of the firm of Anderson & Christie, Consulting Engineers, Durham, N. C.

'14. Thomas F. Danforth of 23 North Street, Buffalo, N. Y., is with the John W. Danforth Company, 70-72 Ellicott Street, engaged in Government Construction work. He was honorably discharged from the Army on March 5th, having been at Camp Humphreys, Va., for nine months.

'14. E. W. Hall is at Harrison, N. J. as Chief of Draftsmen in the Atha Works of the Crucible Steel Company of America. His residence is at 107 Linden Ave., Arlington, N. J.

'14. Charles Kirschner is Drainage Engineer, Bureau of Public Works, U. S. Department of Agriculture, Tulane University, New Orleans, La. He was honorably discharged from the army in December 1918 and in January 1919 was married to Miss Edna LeBesque of New Orleans. His residence is 1327 Esplanode Ave., New Orleans, La.

'14. Emory W. Lane is a Computer in the Miami Conservancy District, Dayton, Ohio. His address is Box 138, Y. M. C. A., Dayton, Ohio.

'14. Walter C. McCrone is in the Production Department of the Chase Metal Works. His address is Department 419, care of Chase Metal Works, Waterbury, Conn.

'14. Neil McMath is a 2d Lieutenant, 185 Aero Squadron, A. E. F. His permanent address is 215 Iroquois Ave., Detroit, Mich.

'14. Edward J. Mershon is a Contracting Engineer with the Pittsburgh-Des Moines Steel Company, 807 Curry Building, Pittsburgh, Pa. His home address is 27 Spring Street, Brockport, N. Y.

'14. John M. Phillips of 509 Laurel Ave., Bridgeport, Conn., landed at Charleston, S. C., on April 18, and expects to be a free man soon.

'14. Leroy P. Raynor is Assistant City Engineer of San Francisco, Calif. He lives at 860 Bush Street.

'14. Richard E. J. Summers of 508 McNair Ave., Wilkesburg, Pa., sailed for France July 9, 1917 with the 15th U. S. Engineers, the first Engineers unit to reach France. After fourteen months service in France he returned to the United States for assignment to the new sapper regiment for work in Siberia. The signing of the armistice brought to an end this plan. Captain Summers resigned his commission March 29, 1919 and is now a structural steel detailer and checker for McClintic-Marshall Company of Pittsburgh.

'15. Peter E. Bermel is Captain in the 303d Engineers located in France. His home address is 450 Morris Street, Albany, N. Y.

'15. Alvin G. Cadiz of 473 14th Street, Brooklyn, N. Y., is in the Production Department of the Groton Iron Works, Groton, Conn. This company is building nine steel steamships.

'15. Mathew L Carey of 141 Washington Pl., New York City, is located temporarily at the New Haven Plant of the U. S. Rubber Co.

'15. Earle E. R. Dornbach, at present is in France with the A. E. F. Since April 1918, he has been a Sergeant in Co. "C" of the 303 Engineers. His home address is 108 W. Main Street, Mechanicsburg, Pa.

'15. H. Shailer Dow is Engineer at the Chicago Union Station Company, Chicago, Ill. His home is 312 Lee Street, Evanston, Ill.

'15. Robert L. Glose of 447 S. Rebecca Street, Pittsburgh, Pa., is Sales Engineer for the H. H. Robertson Company, of the same place. He was honorably discharged from the U. S. Army in March. He served as Captain with the 79th Division, A. E. F.

'15. John E. Harn has left the Research Department at McCook Field, Dayton, O., and returned to Baltimore resuming his position of Secretary and Treasurer of the Willard H. Harn Company, Builders, 2314 Oak Street. His son, Edwin Willard Harn, expects to take a C.E. degree at Cornell in 1940.

'15. Charles Heidt is a Reserve Military Aviator. His present address is 973 Whitlock Ave., New York, N. Y.

'15. Henry D. Lott of 370 East 23d Street, Brooklyn, N. Y., is a Civil Engineer at Cape May, N. J.

'15. Jules E. Rosenthal is Civil Engineer for Rosenthal Engineering Contracting Company, of 226-8 Jackson Street, Brooklyn, N. Y.

'15. Gordon A. Sarstedt has just returned to civilian life after 14 months in the service in aerial photo work, seven months of which was in France. He is now Secretary and Treasurer of the Cleveland Macadam Company, 1040 Leader News Building, Cleveland, Ohio, and lives at 1940 East 90th Street.

'15. Erich E. Schmied was discharged from the Air Service as Second Lieutenant on January 21, 1919. He is now Civil Engineer with the Morgan Engineering Company, Memphis, Tenn. His permanent address is 224 Aisquith Street, Baltimore, Md.

'15. George W. Supplee is Assistant Engineer, Philadelphia and Reading Railroad, Port Richmond, Philadelphia, Pa. His home address is Haddon Heights, N. J.

'15. Edward J. Thomas of 1002 W. Lafayette Ave., Baltimore, Md., is Superintendent of the DuPont Chemical Company, Penniman Works, Penniman, Va.

'15. C. B. Watkins is a Junior Lieutenant, U. S. N. and is in the Public Works Department at the Naval Operating Base, Norfolk, Va.

'15. H. B. Wright is now employed in the Estimating Department of the Sinclair Oil Company, at 608 Conway Bldg., Chicago, Ill. His home address is 6038 Dorchester Ave., Chicago, Ill.

'16. Fred C. Brandes is Instructor of Drawing and Civil Engineering in Catholic University, Washington, D. C. His home address is Mamaronck Road, White Plains, N. Y.



'16. Henry Alden Foster of 205 Garfield Place, So. Orange, N. J., is a Corporal with Co. "A", 29th Engineers, A. E. F., A. P. O. No. 714. His outfit is located at Langres, France.

'16. Felix S. Hales has been discharged from the Army as a second Lieutenant in the Field Artillery. He is now a Bridge Draftsman on Grade Elimination for the New York Central and St. Louis Railroad. He can be reached at 1707 Belmar Road, Cleveland, Ohio.

'16. Harold L. Hock is still with the 2d Engineers, 2d Division, as a Lieutenant in the Army of Occupation in Germany. His home address is 150 W. Main Street, Middletown, N. Y.

'16. S. E. Hunkin of 17830 Lake Avenue, Cleveland, Ohio, is Construction Superintendent with the Hunkin-Conkey Construction Company of Cleveland. He returned from France March 24 as Captain in 112th Engineers, 37th Division.

'16. Wayne Mac Veagh is Assistant Supervisor of Track, W. J. & S. R. R., Woodbury, N. J. His home address is 472 Hepburn Street, Williamsport, Pa.

'16. John R. McCarthy is a Junior Engineer with the H. L. Doherty and Company. He may be reached at the Doherty Junior Engineers' Club, 1704 Jefferson Ave., Toledo, Ohio.

'16. K. P. Moore is an Ensign, Naval Aviation, U. S. N. R. F. His home address is 49 N. Fullerton Ave., Montclair, N. J.

'16. C. B. Moore is a Second Lieutenant of Engineers in the office of the Department Engineer, Charleston, S. C. His home is in Marion, Ala.

'16. Frederick B. Mullen at present is with the Sorbonne Detachment, A. P. O. 702, A. E. F. He is a Master Engineer, Junior Grade taking a Post Graduate Course at the Sorbonne University, Paris, France. His home address is 448 Hillside Ave., Jamaica, N. Y.

'16. Martin A. Neumaier of 1417 Grand Concourse, New York City, at present is a Sergeant, Q. M. A. E. C., A. P. O. 762, LeMans, France.

'16. Lieutenant "Les" Pierce, U. S. Air Service, is head of the Aeronautical Research Department at McCook Field, Dayton, O.

'16. George W. Rapp was honorably discharged from the service on March 14, 1919 as a 1st Lieutenant, 350th Field Artillery, after having been eight months in France. He is now in the Engineers Corps, Cincinnati, Division, Pennsylvania Lines, and lives at 1337 Chapel Street, Cincinnati, Ohio.

'16. Theodore C. Rogers is in the Engineering Department of the American Telephone and Telegraph Company, with Headquarters at 105 Broadway, New York City. He will be in Phoenixville, Pa., this summer. His permanent address is 88 Chestnut street, Binghamton, N. Y.

'16. Samuel Strumer is a 1st Lieutenant, C. A. C., Sorbonne Detachment, A. P. O. No. 702, Paris, France. His residence is 1211 Vipe Ave., Bronx, N. Y.

'16. Chester A. Thompson of 158 Dana Ave., Albany, N. Y., is with the G. & J. Tire Co., Indianapolis, Indiana. He returned from France in March after thirteen months in the A. E. F., as a 2d Lieutenant with the 20th Engineers.

'17. W. Reese Dillard is a 1st Lieutenant, 17th Engineers, France. At present he is with the Transportation Department, American Food Administration and is stationed at Trieste.

'17. Aran H. Dimijian is still in service. He is a Master Engineer, Senior Grade, with the 419th Det. Engineers, A. E. F., and has been located at Toms, France, since January 1918.

'17. J. F. Driscoll is with the H. H. Robertson Company, 170 Broadway, New York City. He lives at 117 Waverly Place, New York City.

'17. Charles Harold Fahy saw service in the Naval Reserve with the rank of Ensign, and was placed on inactive duty January 1919. He is now with the Niles, Bement, Pond Co., care Niles Tool Works, Hamilton, Ohio. His home address is 21 Arnold Park, Rochester, N. Y.

'17. Robert D. Ingalls of Phelps, N. Y., is now at the U. S. Engineers School, Camp Humphreys, Va. While overseas with the 5th Engineers he was Captain of Co. D.

'17. Cushing Phillips is a Lieutenant (j. g.) U. S. N., Executive Officer U. S. S. R-6, Navy Yard, Boston, Mass. His home address is 1150 84th Street, Brooklyn, N. Y.

'17. Fred W. Roberts is a Lieutenant with the 318th Engineers A. E. F. He is now with the Army of Occupation in Germany. His home address is 1471 High Street, Denver, Col.

'17. W. L. Saunders who was a Captain in the Air Service, was discharged from the army on March 4, 1919. He is now a Concrete Inspector on Army and Naval Base Roads at Norfolk, Va. He gives his permanent address as 1323 Columbia Road, Washington, D. C.

'18. I. C. Chan is inspector for the New York Central Railroad Co., Tonawanda, N. Y. He is rooming at the Central Y. M. C. A., Buffalo, N. Y.

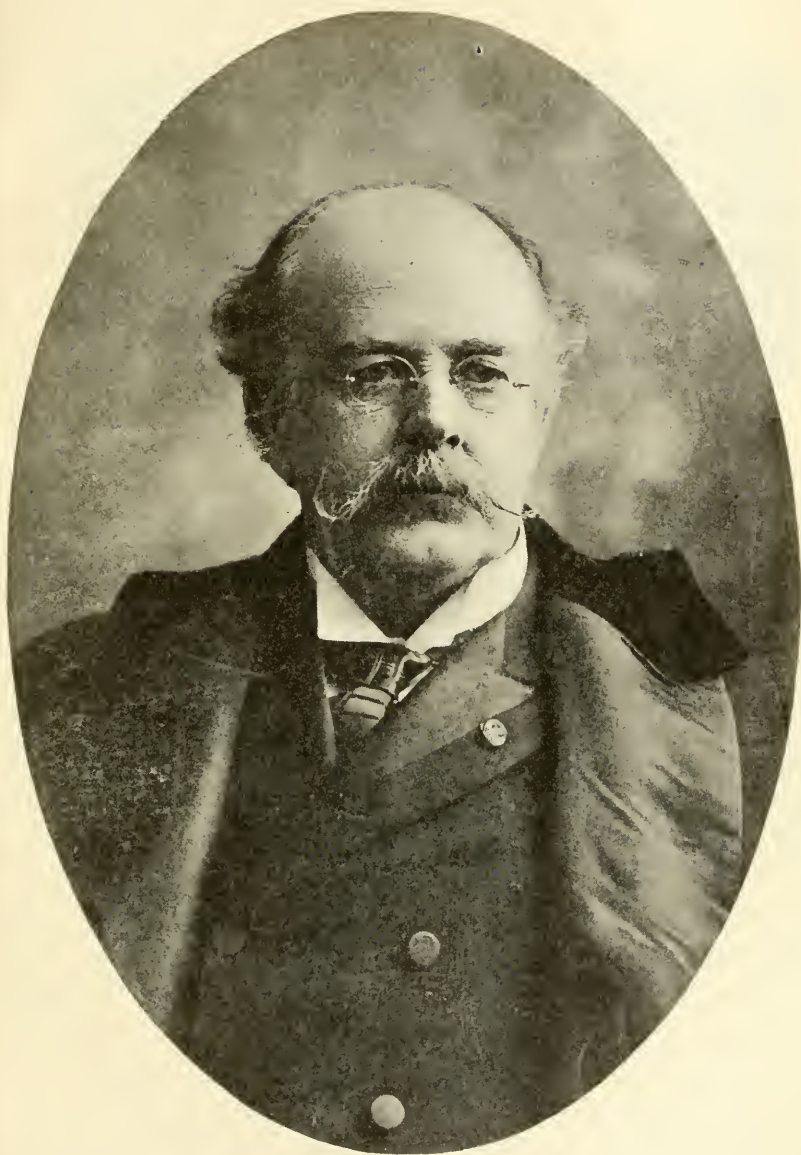
'18. A. Stuart Collins is a Civil Engineer now connected with the Rankin Plant of McClintock-Marshall Co., at Wilkinsburg, Pa. He may be reached at 415 Biddle Avenue.

'18. James W. Fitzgerald has just been honorably discharged from the service and is now Assistant Cashier in the National Exchange Bank, Clayton, N. Y.

'18. William M. Jones returned from France on March 1st with the 41st Division. He lives at 480 Convent Ave., New York City.

'18. Alfred Mullikin is a 1st Lieutenant in the 82d Sanitary Corps and is stationed at Brest, France.

'18. Andrew J. Whitney, 3d, is a Rodman for the Pennsylvania Railroad at Buffalo, N. Y. His home address is 82 Linwood Ave., Buffalo, N. Y.



E. A. FUERTES



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# THE CORNELL CIVIL ENGINEER

AND

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## CONSTRUCTION OF CAMP MEADE

By R. F. Proctor, Lt. Col. Q. M. C., U. S. A.,

Constructing Quartermaster

After the war in Europe had been raging for two and two-thirds years, the United States found itself a participant therein. The country had hoped to keep out of this World War, for which there had been very few preparations made, except those incidental to supplying certain war necessities of European nations.

War was declared on April 6th, 1917, and on April 12th the Secretary of War declared that an emergency existed in the meaning of Section 3709, Revised Statutes, under which emergency construction could be carried on without resorting to advertising and the taking of competitive bids. The Selective Draft Law was passed on May 16th, 1917.

It is the Quartermaster Corps and not the Engineer Corps that attends to construction work incident to army posts. In the Quartermaster General's office there had been in peace times a Division of Construction and Repair, and at the outbreak of the war it was composed of three officers, Colonel I. W. Littell, Captain Oury and Captain Marshall, with an office force of about 20 clerks and stenographers, and 20 engineers, architects and draftsmen. At the Regular Army posts this force kept all structures in repair and made such extensions as were necessary from time to time to house the Army.

When the war broke out it was this division that faced the task of housing the enormous increase in the personnel of the army. It was not known whether or not the conscription bill would become a law until definite action had been taken by Congress. Hence, until Congress passed that law, plans could really assume no formal shape. All that could be done was to build additional barracks at the various army posts, to provide officers' training camps to supplement those already in existence, and provide aviation fields and the like.

During the first six weeks of the war—April 6th to May 16th—about six million dollars worth of work was out under contract for additional housing facilities for the army, and this was done through the Construction and Repair Division of the Quartermaster General's office. Although there was no definite intimation as to what Congress would do with the Selective Draft Law, still in anticipation of a tremendous increase in the size of the army, investigations of new camp sites were ordered on May 7th, one month after the declaration of war.

It was soon apparent that the Construction and Repair Division was not properly organized for the tremendous task of housing the new armies and in order to carry to prompt completion a fast building program, it became necessary to organize a separate division of the Quartermaster General's office, and this was done by authority of a letter from the Adjutant General dated May 19th, 1917, by which Colonel I. W. Littell, Q.M.C., was assigned to take charge of a subdivision which was given the name of the Cantonment Division. To this new organization was assigned the work of construction of cantonments and camps.

To realize the magnitude of the problem in hand—that of housing our new army—it may be said that at this period the program was to provide housing for an increase of about 1,100,000 men, to be added to the Army of the United States. The total of our army, both Regular and National Guard, in field service in April, 1917, including Reserve Officers, was 212,034 men. In March, 1918, we had a total army of 1,652,725—in other words, a growth of 1,440,691.

Up to the time of the passage of the Conscription law providing for this new army, only tentative plans for its size, housing, equipment and training could be made. The minute the law was passed, began the turning point in preparatory steps, and immediately there was instituted a definite program along various lines. The Secretary of War was then in position to act on numerous matters which had been under advisement by the General Staff and the Munitions Board and the Council of National Defense which had formed a sub-committee on emergency construction of buildings and engineering structures.

The General Staff determined that Cantonments should be constructed in 16 different places situated in the several sections of the country so that each site would have a tributary to its pro rata share of the conscripted army. There were also to be 16 federalized National Guard Camps, and these were to be located mostly in the South and West where climatic conditions would permit training practically throughout the year. The General Staff directed the Commanding General in each of the six departments of the army to select the sites.

The Commanding Generals who received the preliminary orders on May 7th were instructed to report by the end of May. Reports were sent to the General Staff, who decided on the sites subject to the approval of the Secretary of War, and most of the cantonment sites were selected in this manner early in June and the last was approved on June 27th. The Camp Meade site was approved June 22d.

I was called to Washington the latter part of May, and asked if I would take charge of the construction of one of the camps. This I agreed to do, and on June 19th I was commissioned a Major and detailed as Constructing Quartermaster in charge of the construction of the camp at Admiral, Md. Up to that date, as stated above, the site of the Camp had not been definitely determined, nor had the contractor been selected, yet I was instructed that the camp must be ready to receive drafted man on September 5th. The contractor was selected and contract signed on June 27th, and on July 2d the construction work of building Camp Meade was actually started in the field. This gave me exactly 65 days in which to prepare for the draft. The plans provided for building a city capable of housing 41,500 men, furnishing a modern water supply, sewerage system, interior as well as street lighting systems, hospital, theatre, library, ice manufacturing plant, laundry, warehouses, stables, garbage incinerator, etc.

As to the plans for the camp, I was given a typical layout, the same as the other constructing Quartermasters which showed the camp layout in a straight line, with the alternative of laying it out in the form of a horseshoe. My instructions were to lay the camp out in either one of these two methods, or in some modification of them depending upon topography. In other words, the layout had to be adapted to the existing topography. Detailed plans were furnished me of typical buildings and the relative locations of these buildings.

It must be remembered that it was not until June 15th that Congress appropriated funds, and prior to that date it was impossible to make any expenditure—in fact, a complete organization of the Cantonment Division was not possible until after the appropriation was made. Therefore it is evident that Colonel Littell, as head of the Cantonment Division prior to June 15th, had to rely on the volunteer services of civilians in a large measure, and it was only possible to get out very general plans. Furthermore, it should be pointed out that no one had any very definite knowledge of the sites on which the cantonments were to be built.

From a construction standpoint the site at Admiral was a very difficult one. There were no roads, no railroad into the site, and an immense amount of clearing of trees necessary. There was no water for drinking

purposes in sufficient quantities to take care of the tremendous population of the laborers dumped into the place almost in 24 hours. During the construction work in the summer of 1917 we were constantly faced with a water famine, and it was only by the most tremendous efforts on the part of the contractors that we were able to furnish sufficient drinking water to hold our men. On several of the very hot days of August we lost hundreds of carpenters because we could not get water to them while they were working in the sun. Sand covered almost the entire area, and we found it impossible to use motor trucks in that soil, and therefore for the principal part of our hauling we had to use teams and wagon gears. At one time we had 600 teams hauling lumber alone.

From a health standpoint, however, I believe that the Admiral site was very wisely selected. The drainage, because of the sandy soil, was perfect, and I do not believe that there was any other camp in the country, with the possible exception of that constructed at American Lake, Washington, where the drainage was any better, and I know that in the majority of cases the drainage was poorer than at Meade.

Immediately upon arriving on the ground I instructed my engineers to make a careful survey of every well on the leased property. Samples of water were taken and analyses made to determine whether the water was safe for drinking purposes. Wherever there was the slightest doubt, I had the well closed, and for further protection during the first days of construction, all drinking water was chlorinated. Later, as the deep wells which were started the first day of the construction work, began to yield, the chlorinating was dropped but samples of the water used for drinking purposes were sent for analysis every week in order to be perfectly sure that the men were in no danger from this source, and I am very glad to say that during the entire construction period we did not have a single case of typhoid fever. I am also glad to say that in the early days of the occupation of the camp by the drafted men the health conditions, according to the Surgeon General's reports, were shown to be the best of any of the 16 camps. Every precaution possible was taken to keep the soil clean and free from pollution, as the health of those who were to come after the construction forces left would depend to a certain degree upon this, and we dealt very rigorously with all the laborers in all matters of sanitation and in their habits of living.

It may be interesting to note the manner in which the contractors were selected for the building of the cantonments. While preliminary data was being secured of possible sites, and while Congress was still considering the appropriation bill, the Emergency Construction Committee of the Council of National Defense proceeded to secure data in connection with contracting firms capable of handling work of the

magnitude and kind involved and who had at hand organizations and financial resources adequate to permit of their executing the construction work of a cantonment at a phenomenally high rate of speed. Questionnaires were sent to various contracting firms who had handled work of magnitude during the two preceding years. Contractors were selected by a sub-committee of five men under the chairmanship of a Major W. A. Starrett of the Committee on Emergency Construction. These selections were made on the basis of past experience of the contracting firms for handling work on a large scale and the findings were reported to the Munitions Board. The recommendations were then sent to Colonel Littell, who placed the evidence before the Secretary of War for approval. This procedure was followed consistently in all the work undertaken by the Cantonment Division, and later by the Construction Division.

Taking everything into account it is the general consensus of opinion by those who have been closely associated with the activities of the Cantonment Division, that these contractors were selected wisely and it is a fact that they delivered the camps on schedule time. It is certain that political influence got very little regard in their selection. It is also to be said to the credit of the contractors that there was a number of them who were willing to undertake this work for the customary \$1.00 plus expenses. The contractors, on a whole, made a most creditable record.

The form of contract under which the camps—in fact, all construction work under the Construction Division—was handled deserves special attention. Up to within a few years it has been customary, and in connection with many lines of work it is still customary to take competitive bids for construction. These bids, however, can only be properly prepared when based upon detailed plans and specifications. In the construction of the camps, it was proposed to build upon an entirely undeveloped tract of land a city capable of housing an average of 40,000 persons. This city was to be complete, with housing, railroad tracks, roads and all the various utilities. The sites for the cantonments were not selected until the period from May 24th to June 27th, and the construction had to be sufficiently advanced so that the cantonment could accommodate the first consignment of drafted men by the 5th of September, and were to be completed so as to house the entire personnel by the middle of November. Under the circumstances, detailed plans and specifications could not be prepared and the competitive bids were therefore entirely out of the question either on a lump sum or unit price basis. It would not have been fair either to the Government or to the contractor. The time was short and the market



for labor and materials extraordinarily unstable, and likely to become more so due to the extraordinary demand for the labor and material required in this particular work. It was, therefore, determined to adopt a form of contract known as the "Cost Plus a Sliding Scale Fee" with a maximum fixed limit. Having operated under that form of contract for one and one-half years, and having had many years' experience in construction under the usual competitive form of contract, I am convinced that the form used in this emergency by the Government was extremely well adapted to the work in hand, tending toward fairness, expedition of the work and freedom from legal complications.

The tremendous amount of construction going on in the various parts of the country in connection with the war immediately placed upon the material markets a series of demands which required special arrangement, in order that the construction program could go forward systematically and effectively. On this account in the Construction Division there was organized a Materials Branch, which made up lists of all available manufacturers of those items needed in the construction of the camps. Orders for lumber, iron and wood pipe and a number of other items were placed with the lumber and other committees who established offices in Washington. These committees, serving as aids to the War Industries Board, fixed the prices to be paid and allotted the orders to the various manufacturers throughout the country best able to furnish prompt deliveries. If this method had not been adopted, 32 Constructing Quartermasters with their contractors would have competed with one another in attempting to obtain materials necessary to carry out their construction programs. The wisdom of having all similar material ordered through central agencies became so apparent that this policy was adopted in all the Departments of the Government.

At the beginning of the construction an agreement was made between the Secretary of War and Mr. Samuel Gompers, representing the American Federation of Labor that the rates of labor to be paid at the various cantonments and camps would be in accordance with schedules in effect June 1st, 1917. Immediately upon starting the construction work the demand for labor at each camp site became very great. It must be remembered that many of the cantonments and camps were located at places remote from labor markets and from 10,000 to 14,000 men were employed on each project. The law of supply and demand soon became operative, the cost of living began to soar and the result was that prices paid for labor increased as the war continued. My payroll records show that the ratio of total payroll at rates paid in January, 1919, to that paid at the beginning of work at Camp Meade

in 1917 to be 1.213. These figures show that the cost of the work, due to the increase of wages, was advanced 21 per cent, taking as a basis the rates paid on all classes of labor at Meade when it was started and the rates paid at Curtis Bay Ordnance Depot when the work was finished. This figure, of course, only applies to my work and the Baltimore locality. I have no knowledge of the rates of other Constructing Quartermasters. Taking everything into consideration I believe that the Government handled the labor problems very wisely. We have heard criticisms as to the exorbitant wages paid, but it must be borne in mind that the progress of the work had to be maintained without interruption, the demands for labor were so great that there was not sufficient to fully supply all jobs and that the cost of living advanced very rapidly.

Each Camp had its own problem in the matter of furnishing water supply. Many of the camps were able to get their water supply from existing city supplies. This was not the case at Camp Meade, and I found the water problem there a very serious and complex one. We first made an investigation whether or not water in sufficient quantities could be obtained from deep wells. I was instructed to furnish a water supply of 2,220,000 gallons per day, or roughly 55 gallons per man a day, and it soon developed that this supply would have to come from the Little Patuxent River. Wells were driven, starting the day we began construction work, and continued through that period, but the water from these wells was only sufficient to keep up with the temporary demands made by the army of laborers building the camp. Therefore, while we were developing a deep well supply construction was started on a supply to be obtained from the Little Patuxent River. The character of water in this stream was such that it necessitated a filter plant. Therefore, we had to build two pumping stations, one to pump the water from the river through the filters, the other to pump the water from the filters to the storage tanks. Camp Meade was the only cantonment where the water had to be filtered and sterilized. Wood stave pipes were used for the mains, in order to save iron for other army purposes, and it will be interesting to note that all the wood pipe used at Camp Meade came from the Pacific Coast.

At each cantonment a system of sewers was built for the removal of house sewage only. Surface drainage was not admitted to the sewers and wherever such drainage was needed, ditches were used. At Camp Meade was constructed a sewage disposal plant, consisting of septic tanks and sludge bed. The effluent from the septic tanks was emptied directly into the Little Patuxent. This method of disposing of the sewage was approved by the State Board of Health of Maryland.

At Camp Meade there were two types of roads built—concrete road passing the warehouses and storehouses, and connecting the Base Hospital and two main regimental roads, passing north and south through the camp, made of gravel obtained locally, which has given very satisfactory results. No attempt was made to build walks and such as were constructed were made of waste lumber by the soldiers themselves.

All interior lighting was electric, the current being supplied by the Washington, Baltimore & Annapolis Railway. A system of street lighting was also installed. All the barrack buildings were furnished with large room heaters. The officers' quarters at Camp Meade were heated by steam from small individual plants. At the base hospital we installed a central steam heating plant.

A steam laundry was built, the privileges of same being leased to an operating company. The working out of this plan was not satisfactory, however, and later it was found necessary for the Camp Quartermaster to take over and operate the laundry, cancelling the contracts with the operating company.

Great care was taken in laying out the camp to protect it from fire. Fire breaks were left, and the spacing between individual buildings was such as to eliminate, as far as was possible, danger from a general conflagration. Hydrants were installed and the water supply pressure was sufficient to furnish protection from this source. The hydrants were placed so that 16 streams could be concentrated on any of the large barracks building with lines of hose not exceeding 500 feet in length. First aid fire extinguishing apparatus was furnished in all buildings. Hose carts carrying 500 feet of fire hose and equipped for use of these barracks were furnished. There was a military fire company organized of men having had training in paid fire departments throughout the country, and three fire houses were built at Camp Meade, equipped with motor fire trucks, carrying all the usual equipment of a city fire department. There was also installed a fire alarm system consisting of special telephones throughout the camp, as well as a large siren for the general notification. The great care in regard to the matter of fire resulted in no fires of serious consequence during the construction period at Camp Meade, and I understand that this was generally true in all the cantonments. The total property loss from fire during strictly the construction period of all cantonments is admitted to have been about \$2,000.

The buildings at Camp Meade, of which there were about 1,800 constructed under my direction, covered an area of about 1,800 acres. There was roughly 50,000,000 feet of lumber used in the construction

of these buildings. The following is a list of some of the more important items that went into the construction:

Doors 12,167, window sash 73,052, nails 12,000 kegs, wood stave pipe 104,524 feet, V. S. pipe 249,000 feet, steel supply pipe 581,000 feet, wire for lighting 410 miles, cement 22,245 barrels, radiation 140,000 square feet, cannon stoves 1,402, room heaters 1,275, shower heads 2,400, water closet bowls 3,381, fire hose 21,000 feet, fire pails 10,000, kitchen stoves 511, iron cots 46,300.

The maximum speed in erection of buildings was accomplished in the construction of the housing for three training battalions which was not authorized until the latter part of September. The housing for each battalion consisted of 51 buildings, 32 of which were two story barracks. The buildings for each unit required 1,490,000 b.m. of lumber, 221,000 sq. ft. of tarred building felt, 152,000 sq. ft. rubberoid roofing, 3,838 window sash, 304 doors, 136,400 sq. ft. of wall board, 782 sq. ft. of brick hearth, 30,514 pounds of nails, 2,108 posts.

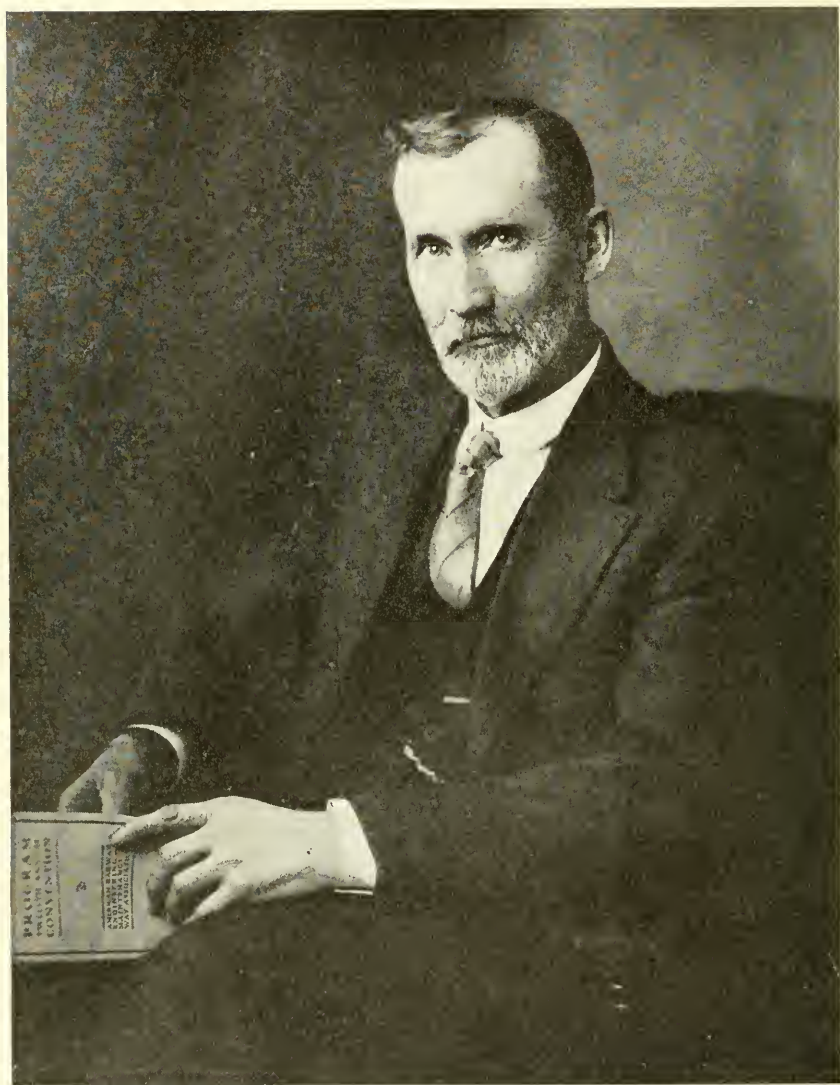
The carpenters and laborers were transported on motor trucks to and from their work as there was no housing for them in the locality of these training camps. The lumber had to be hauled by two horse wagons for a distance of about two miles to the site of the work. The ten hour work day was the rule throughout the construction of this work. The first unit of buildings was completed in 100 hours working time, 15,000 b.m. feet of lumber per hour being erected into the finished buildings, an average of slightly less than two hours per building being maintained throughout the period of construction.

On December 15th, 1917, I received orders relieving me from duty as Constructing Quartermaster at Camp Meade and detailing me as Constructing Quartermaster for the construction of the Curtis Bay Ordnance Depot, Curtis Bay, Md. At that time Camp Meade had cost \$10,400,000. The contractors, Smith, Hauser & MacIsaac, Inc., of New York, were also relieved of further work at Camp Meade and given the contract for building the Curtis Bay Ordnance Depot. At that time Major E. B. Whitman was detailed as Utility Officer for Camp Meade and to him I turned over the operation of the Camp.

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The engineer who devises and executes public undertakings of magnitude must always be prepared for the unexpected and therefore must be resourceful. It is not unusual to encounter difficulties not anticipated. These must be surmounted or failure is inevitable. A solution must be found without delay or great interests are imperiled --*Carhart*.



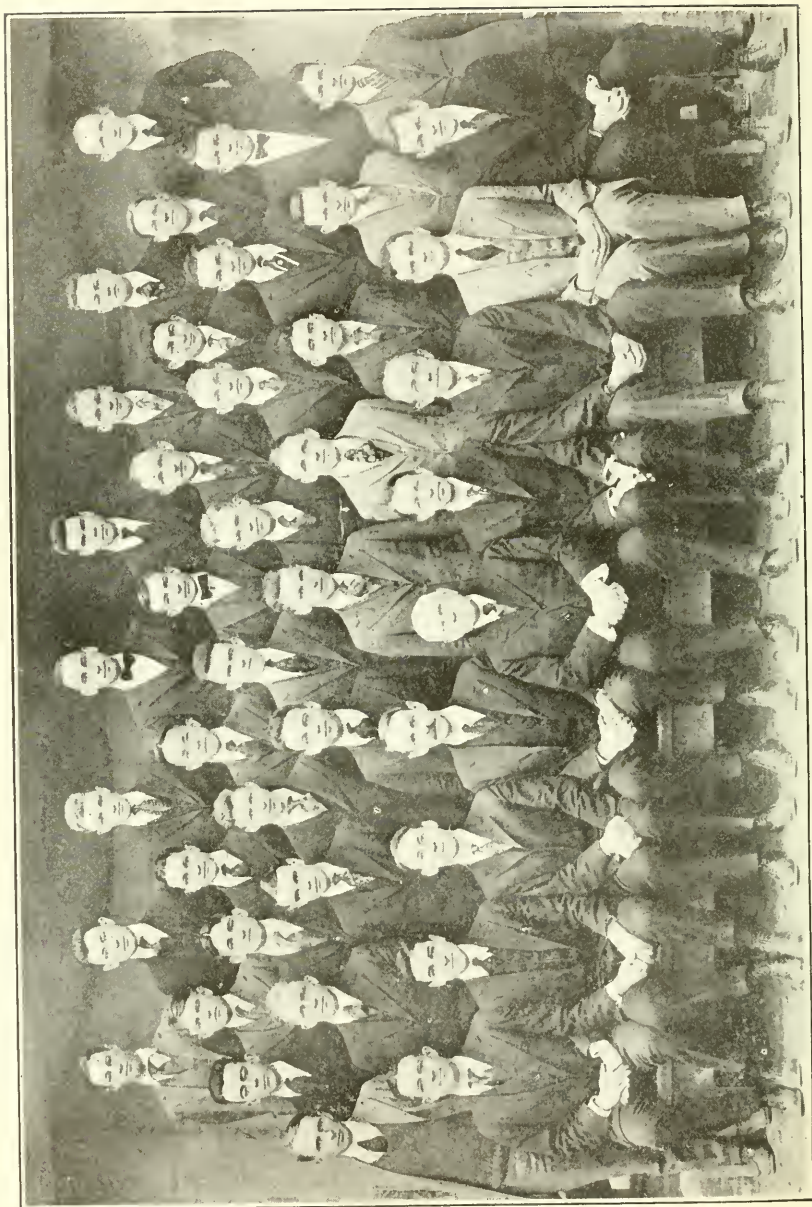


CHARLES LEE CRANDALL





IRVING PORTER CHURCH



1919 CLASS PHOTOGRAPH

## KEY TO THE 1919 CLASS PHOTOGRAPH

### First Row (left to right)

- 1 Knowlton, G. E.
- 2 Robinson, D. M.
- 3 Walker, C. L.
- 4 George, S. G.
- 5 Haskell, E. E.
- 6 Underwood, P. H.
- 7 Rettger, E. W.
- 8 Barnes, F. A.
- 9 Crane, F. W.

### Third Row

- 1 Waldo, R.
- 2 Cohen, M. G.
- 3 Cook, J. R.
- 4 Haley, F. A.
- 5 Bullard, G. P.
- 6 Lindberg, H. E.
- 7 Lynch, J. H., Jr.
- 8 Smith, R. L.

### Fifth Row

- 1 Wilson, P. S.
- 2 Kaufman, S.
- 3 November, N.
- 4 Herman, A. P.

### Second Row

- 1 Bemis, L. E.
- 2 Rogde, S.
- 3 Constans, F. S.
- 4 Weidberg, N.
- 5 Dittmar, A. L.
- 6 Howell, C. J.
- 7 McClure, J. H.
- 8 Hough, F. W.
- 9 James, W. B., Jr.

### Fourth Row

- 1 Michelson, B. C.
- 2 Smook, J. M.
- 3 Ma, Y. C.
- 4 McDearmon, G. W.
- 5 Sewell, O. J.
- 6 Phillipson, R. A.
- 7 Hiscock, G. S.

- 1 Stott, C. A.
- 2 Gebhard, J. C.
- 3 Wright, C. A.
- 4 Grantz, W. A. H.

# THE CORNELL CIVIL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR BY

The Association of Civil Engineers of Cornell University  
Ithaca, N. Y.

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## EDITORIALS

### The Consolidation of the Engineering Colleges

*"Whereas, the Committee appointed to consider and report on ways and means for the development and reorganization of Engineering Education at Cornell University, after further inquiry and investigation now definitely advises the consolidation as recommended in principle in a report to this Board under date of May 16, 1918, therefore be it*

*Resolved, That there be instituted a college of engineering which shall conduct all branches of Engineering Education given at this University, effective with the commencement of the Fall Term, 1920, for the freshman class and with the Fall Term of 1921 for all other classes."*

The much-debated plan for the consolidation of Engineering Education at Cornell will commence to be operative next fall, and the unification of the Engineering Colleges will be consummated by the Fall of 1920. This matter has been the object of careful consideration for over a year and a half by a committee appointed by the Board of Trustees consisting of H. H. Westinghouse, Chairman, R. H. Treman, James H. Edwards, J. DuPratt White, and Ira A. Place along with the Deans and the members of the Conference Committees of the faculties of the two engineering colleges.

The Faculty members of the committee, on request of the Trustee members, made a report on February 26, 1918, which included a general discussion of the problem and needs involved in teaching engineering at Cornell and which recommended specifically the consolidation of all engineering into one administrative group: In May, 1918, the committee reported in part as follows:

*"On the paramount and fundamental question as to whether or not the present segregated status of the Engineering Colleges should be retained, or a plan of consolidated Engineering Education be substituted therefore, it was found that the views of the Faculty and Trustee members of the Committee, independently arrived at, were in substantial*



accord, as favoring in principle the consolidation of the several existing engineering departments into one department of Engineering Education, a course apparently justified by the experience of other comparable educational institutions."

The Board of Trustees, without committing itself to final action, approved in principle the findings of the committee and authorized it to make further investigation of the subject.

In a joint circular letter under date of October 1, the Deans of the Colleges of Civil and Mechanical Engineering informed the technical alumni of the plan for the combining of the College of Civil Engineering and Sibley College and heartily advocated it. This was the first information given out to the alumni after the initiation of the investigation nearly a year previously.

There was considerable opposition to the consolidation among the Faculty of the College of Civil Engineering and it was felt that due regard was not given to securing the consensus of opinion of the Faculty. The committee of the Board of Trustees, having been advised in a communication from the Faculty of this opposition, invited several Faculty members to appear before it and orally support the views expressed in the communication. In the report of the committee of April, 1919, Mr. Westinghouse says:

*"Various aspects of the subject were freely considered, developing explanations which it is believed removed some misapprehensions of fact on the part of the members of the Faculty who were present. Full consideration was given to all that was presented, but without changing the views of your Committee as expressed in the report of May 16, 1918. Valuable suggestions, which will receive careful consideration, with regard to the administrative and educational composition of a unified college of engineering were made, but as these features have thus far received only preliminary consideration by your Committee, it was felt that they were not pertinent to the particular question then under consideration. Assurances were given by members of the Civil Engineering Faculty Committee that aid and support would be rendered by them in working out a comprehensive plan for the betterment of Engineering Education at Cornell University."*

He further says:

*"If this recommendation (consolidation) be acted upon affirmatively, your Committee will then proceed in consultation with faculty and alumni committees to consider the administrative and educational features of the subject. Steps have already been taken to secure the active co-operation of the technical alumni in this task, a joint committee of representatives of the Engineering Colleges have been formed to confer with your Committee and the Faculties of the several interested Colleges in working out, as far as possible through such agency, the more detailed features of the problem being dealt with."*

The College of Civil Engineering is represented on this joint committee by Dean Haskell, and Professors Barnes, '97, George, '05, Seery, Shoder, '03, Underwood, '07, and Walker, '05.

It seems highly desirable that the respective Colleges retain their individuality and remain autonomous organizations, but with a centralized administrative unit. And it is imperative that the new administrative head, who will succeed the present Deans upon their retirement, be selected with the greatest care and be a teacher of some experience, an engineer of proved ability, and a man of the caliber which will make him the head of America's greatest engineering college. Nothing is more vital to the success of the consolidation than the active, altruistic



co-operation of the alumni. It is essential that the ambitions of individual departments be subordinated to the general magnification of engineering education at Cornell. College pride must yield to a finer pride in an Engineering College which, in the days of reconstruction, will lead in the reform, readjustment, and advancement of engineering education and investigation in America.

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**The June List** THE CIVIL ENGINEER is publishing for the 26th year a list of all graduates of the College of Civil Engineering.

The geographical list, omitted last year because of the large number of uncertain addresses, has again been compiled, and it is hoped that this feature will find favor with the alumni.

In the editorial section of last June's issue it was stated that about 225 alumni were in France and the hope was expressed that this year Berlin would demand four pages. It is a matter of pride with every alumnus that 563 graduates of the College were in service, and there is little doubt that most of these, had Germany not begged for an armistice last November, would ere now have marched victoriously through Berlin.

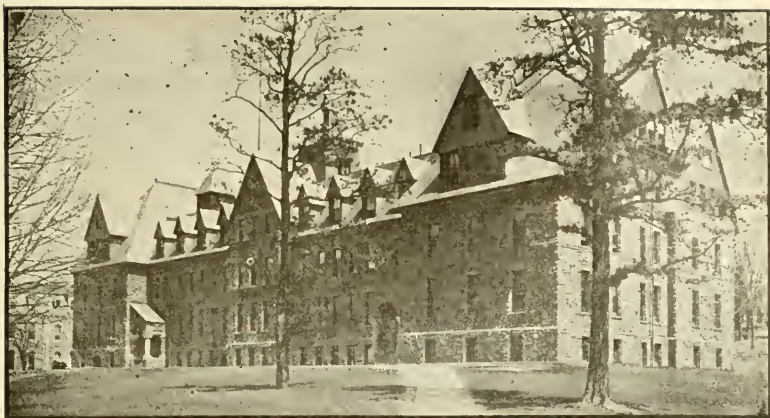
There probably have never been so many changes in occupation and location in a single year as since last June's list was published. An attempt has been made, however, to reach every graduate at least once since January 1, and it is felt that the data given is in most cases reliable. The principal exceptions are the cases of men in service in this country or in units which have been released from overseas service since we went to press. In these cases, however, a special endeavor has been made to give a permanent, or home, address through which the alumnus can be reached.

The compilation of the June list has entailed a large amount of work and THE CIVIL ENGINEER is greatly indebted to Professor Fred Asa Barnes, '97, for his valuable assistance.

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**The Construction of Camp Meade** Cornellians everywhere, both in service and as civilians, had a glorious share in winning the war. There were many opportunities on this side for real men to render a signal service to the country and to no class of professional men did these opportunities make a more direct appeal than to civil engineers. Cornell C. E. alumni are always interested in what their fellow Cornellians have done and are doing and THE CIVIL ENGINEER is very glad to be the medium for conveying information of such interest.

The Semi-Centennial number is enhanced by an article on "The Construction of Camp Meade," by Lieut. Col. Ralph F. Proctor, who had charge of the work.



## COLLEGE NOTES

### Track

Another very successful track season for Cornell was concluded May 31 when the Varsity track team won for the fifth consecutive time the Intercollegiate Championship meet held at Cambridge May 30 and 31.

Track prospects were far from bright early in the season. The return of several former Varsity men considerably strengthened the team, however, and enabled it to capture the four-mile relay, the main event of the Penn Relay Carnival, take second and third places in the 120-yard hurdles, and finish third in the one-mile relay championship race. The weather prevented the holding of the dual meet with Penn and the Varsity's only meet before the Intercollegiates was a dual meet at Annapolis, the team winning ten first places out of fourteen events. The score was 70 to 53.

Notwithstanding this showing the team went to the Intercollegiates with the assurance of the critics that it could not place better than third with Penn winning and Michigan second. Due, however, to the good work of Smith, who won both hurdle events; Watt, who finished second in both; Mayer, who won both the 440 and 880 yard runs and Captain Dresser who won the two-mile run and broke the Intercollegiate record for the distance, making it in 9:22 2-5, the team won the championship and the fourth leg on the cup with a total of 39½ points, Penn finishing second with 29, and Michigan third with 25½ points. To obtain permanent possession of the cup Cornell needs to win it but once more.

It is unanimously conceded that a very large measure of the credit for the brilliant victory of the team is due "Jack" Moakley, the foremost track coach of America.

The 1922 track team won the underclass supremacy from the 1921 track team, and on May 10th defeated the Penn Freshmen team at Philadelphia by a score of 59 to 58. The team was a well balanced one and will add considerable strength to the Varsity next year.

### Baseball

The Varsity baseball team has been greatly handicapped in practice this season by the continued rain and several games have had to be cancelled on account of the weather conditions. Of the scheduled games which have been played the Varsity has won 7 and lost 6. A summary of the season follows:

Opponents	Cornell		
Lafayette	3	2	At Ithaca April 19
St. Lawrence	0	2	At Ithaca April 29
Columbia	7	0	At New York May 2
Princeton	6	3	At Princeton May 3
West Virginia	4	2	At Ithaca May 6
Bucknell	3	7	At Ithaca May 20
Rochester	2	3	At Rochester, May 28
Pennsylvania	5	0	At Ithaca May 31
Rochester	2	10	At Ithaca June 4
Brown	4	1	At Providence June 6
Yale	1	2	At New Haven June 7
Colgate	5	8	At Ithaca June 11
Pennsylvania	2	6	At Philadelphia June 14

One more game with Penn and a game with Dartmouth complete this season's schedule.

The Freshman team concluded their season undefeated except by the Second Varsity. They scored victories over Cascadilla School (2), the Penn Freshmen, and St. John's Military Academy. The 1922 team contained much promising material for next year's Varsity.

### Spring Day Circus

After a lapse of three years, we have again had the opportunity to revel in a real Cornell Spring Day. If anyone failed to "Felix Sited" during the morning of Saturday, May 24, it certainly was not the fault of the

Committee nor of those who so ably assisted them. The numerous shows gave evidence of more careful preparation than has been made for previous circuses; the Police Force was even more active in their search for student culprits to fine than is the notorious "City Gang," and there was plenty of opportunity to "take a chance" should one feel so inclined. The opening of the circus was preceeded by a parade from down-town to Schoellkopf Field; there were numerous well

designed floats, many signs and banners advertising the circus shows, and a lot of real "moosic." The absence of the "old boys" was the only regrettable feature. It might well be added that the day was just as successful from the financial viewpoint as from that of the pleasure seeker.

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**Crews** In the Spring Day races which marked the return of  
**Victorious** Cornell rowing to home waters and the revival of the sport for which the University is best known, the Cornell Varsity defeated the Princeton Varsity by nearly three lengths and the Freshman boat finished four and one-half lengths ahead of the rival Tiger first-year shell. The time of 10:37 made by the Varsity was but eight seconds slower than the two-mile record made by Cornell on Cayuga on Spring Day, 1913.

Although rain had prevented the Yale game the rowing conditions at the time of the race were most favorable. As the observation train of 26 cars swung down the shore, the lake was almost without a ripple.

Mr. Courtney in his seventy-first year watched his crews triumph and again establish Cornell's supremacy on the water.

In the intercollege race Ag crossed the line first, with Arts second and M.E. third.

The crews were boated as follows:

Varsity—Bow Stott, 2 Shepard, 3 Cooper, 4 Brewster, 5 Birchley, 6 Daley, 7 Lounsberry, stroke Knight, coxswain Marx.

Freshmen—Bow Burke, 2 Kay, 3 Hoag, 4 Baldwin, 5 Krug, 6 Green, 7 Olney, stroke Frenzel, coxswain Post.

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**Spring Day** Over thirty fraternities held house parties during the  
**Parties** week-end of Spring Day. Several houses held dances Thursday evening. On Friday the Masque gave two performances of a vaudeville entertainment "Goo-Bye."

In the afternoon there were several tea dances and after the Masque performance in the evening the great event of the festivities—the Junior Prom—was held. No expense had been spared to make this surpass all previous Proms and it surely did. Well over a thousand persons were in attendance. The Armory was artistically decorated and the special lighting effects were very attractive. Music was furnished by two orchestras, each of eleven pieces, from Wilkes Barre and Columbus. When the dancing was concluded at four o'clock a most successful Junior Prom had become history. The circus Saturday morning, crew races in the afternoon, and house dances Saturday night rounded out the festivities of a joyous week-end.

**C. E. Men in Crew and Track** The College was represented on the victorious Varsity crew by C. A. Stott, '19, of Washington, D. C., who rowed bow.

T. C. McDermott, '19, of ———, and J. H. O'Leary, '19, of Clayton, New York, were members of the four-mile relay team which won a brilliant victory in the feature event of the annual Pennsylvania Relay Carnival, at Franklin Field, Philadelphia on April 26. These men were also point winners in the dual meet with Annapolis and in the Intercollegiates. O'Leary won the half at Annapolis, and McDermott was second in the mile. At the Intercollegiates McDermott and O'Leary finished third and fourth in the mile.

**College Athletics** The intercollege track meet held May 17 was won by M.E. C. E., represented by Becker, '22, Eddy, '20, Forster, '21, Hiscock, '19, and Kupfer, '22, finished in fourth place with Arts and Ag in second and third places respectively.

The C.E. baseball team finished the season in second place, having lost only to Vet.

**C.E. Honorary Societies** As a result of the Spring elections to the honorary societies of the College of Civil Engineering the following men were elected Pyramid: E. R. Andrew, H. W. Barnes, E. F. Chobot, M. H. Forster, W. B. Fox, T. S. Hood, E. J. Sherk, M. G. Sullivan.

Rod and Bob: W. A. Andrews, C. V. K. Barker, A. M. Croxton, T. W. Hoff, T. C. McDermott, J. P. Riley, W. R. Thomas.

**Tau Beta Pi** Announcement has been made within a few days of the election of Donald M. Robinson of Mount Vernon, New York, 1918-19 editor-in-chief of THE CIVIL ENGINEER, to Tau Beta Pi.

**Advanced to Professorships** The Board of Trustees in their May meeting appointed Assistant Professor F. J. Seery Professor of Hydraulic Engineering, and Assistant Professor E. W. Shoder, '03, Professor of Experimental Hydraulics.

**C.E. Men in Managerial Positions** L. G. Clay '20 was this year's manager of track, H. I. Hettinger '20, managed Freshman track and will fill the same position next year; A. E. Hunkin '20, was Chairman of the Spring Day Committee and is manager of Freshman football; T. L. Collum '20, is manager of



wrestling; M. H. Forster '21, is assistant manager of tennis; and M. G. Sullivan '21, is assistant manager of golf.

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Inspection of the R. O. T. C. at Cornell was held on May 28th and 29th with Lieut. Col. Schindel of the **the R. O. T. C.** General Staff as inspecting officer. The first day was devoted to a review of the corps, tent-pitching and close order drilling. On the second day a problem in advance guard and outpost work was taken up. Lieut. Col. Schindel expressed himself as very well pleased with the work of the corps. He also said that after inspection a number of the Eastern colleges he considered that Cornell had the best drilled and equipped corps which he had inspected.

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## ALUMNI EMPLOYMENT

In the spring of 1918 the Faculty of the College of Civil Engineering appointed a committee on Alumni Records and Employment and during the following summer questionnaires were mailed to all of the graduates of Civil Engineering since 1911. About one hundred replies were received.

Due to war conditions it seems probable that many of the questionnaires never reached the addresses and the blank on the following page is herewith published for the benefit of those who hitherto have not filled out such a questionnaire. It is also felt that with a return to more normal conditions it may be possible that alumni who did not fill in the above mentioned questionnaire would be wise to do so now.

All information is treated as entirely confidential by the committee, and it is hoped that all of the alumni of the college who desire it may be aided in finding agreeable and suitable positions.

The accompanying blank form should be filled out and mailed to the Faculty Committee on Alumni Records and Employment, College of Civil Engineering, Cornell University, Ithaca, N. Y.

L. C. URQUHART

P. H. UNDERWOOD

S. G. GEORGE, Chairman.

## FUERTES GOLD MEDALISTS

### UNDERGRADUATES

ALBERT LLOYD COLSTEN . . . . .	1895
WILLIAM MACKINTOSH . . . . .	1896
GILBERT POWERS RITTER . . . . .	1897
HARLEY STUART GIBBS . . . . .	1898
GEORGE WILFRED PENFIELD . . . . .	1900
GEORGE EMIL JOHN PISTOR . . . . .	1901
ALBERT HOTCHKISS CHANDLER . . . . .	1902
JUSTIN WYMAN LUDLOW . . . . .	1903
ROSS MILTON RIEGEL . . . . .	1904
JOHN EARL ELLIOTT . . . . .	1905
CHARLES FERGUSON COOK . . . . .	1906
FORD KURTZ . . . . .	1907
BRUNO CHARLES LECHLER . . . . .	1908
GEORGE FREDERICK WIEGHARDT . . . . .	1909
LIONEL MONTEFIORE LEVINE . . . . .	1910
JOHN RAYMUND HOFFERT . . . . .	1911
EDWIN SAMUEL HEALY . . . . .	1912
ROGER WILLIAMS PARKHURST . . . . .	1913
LOUIS ISAAC ZAGOREN . . . . .	1914
HERBERT RIDGEWAY . . . . .	1915
THEODORE CHITTENDEN ROGERS . . . . .	1916
SAMUEL JOHN LEONARD . . . . .	1917
MORRIS HILTON BARNES . . . . .	1918
JOHN CHARLES GEBHARD . . . . .	1919

### GRADUATES

JOHN FILMORE HAYFORD . . . . .	1895
Certain Field Methods Used on the Survey on the Mexican Boundary in 1892-93.	
ELON HUNTINGTON HOOKER . . . . .	1896
Storage Capacity in Lakes and Reservoirs.	
ERASMUS DARWIN PRESTON . . . . .	1897
The Transcontinental Arc from Cape May to San Francisco.	
JOHN CASSAN WAIT . . . . .	1898
Engineering and Architectural Jurisprudence.	
FREDERICK EUGENE TURENAURE . . . . .	1899
Moving Trainload Experiments.	
CLINTON BROWN STEWART . . . . .	1900
Gauging of the Niagara River.	
EDWARD CHARLES MURPHY . . . . .	1901
The Windmill, Its Efficiency and Economic Use.	
HENRY ROBERTSON LORDLY . . . . .	1902
Anti-Friction Bearings.	
WILLIAM KENDRICK HATT . . . . .	1903
Tests of Reinforced Concrete Beams.	
ANSON MARSTON . . . . .	1904
Sewage Disposal in Iowa.	
WILLARD BEAHAN . . . . .	1905
Field Practice of Railroad Location.	
ERWIN ERNEST HASLAM . . . . .	1906
The Importance of Ice Disposal on large Hydraulic Power Development.	

JAMES HILLHOUSE FUERTES . . . . .	1907
Waste of Water in New York and Its Reduction by Meters and Inspection.	
JOHN CLAYTON HOYT . . . . .	1908
Comparison between Rainfall and Runoff in Northeastern United States.	
WILLIAM MARTIN TORRANCE . . . . .	1909
Special Concrete Structures of the Hudson River Terminal.	
RICHARD COLLIER ST. JOHN . . . . .	1910
Supplementary Report on Transportation Subways, No. 1 Location	
Design, Capacity, Operation, Bureau of Eng. of the Dep't of Public	
Works, City of Chicago, Ill.	
WILLIAM LAW BOWMAN . . . . .	1911
Partnership Agreements for Civil Engineers.	
DANIEL WEBSTER MEAD . . . . .	1912
The Flow of Streams and the Factors that Modify it, with Special Reference	
to Wisconsin Conditions.	
HARRY THOMAS CORY . . . . .	1913
Irrigation and River Control in the Colorado River Delta.	
WESTON EARLE FULLER . . . . .	1914
Flood Flows.	
JOHN CHARLES LOUNSBURY FISH . . . . .	1915
Engineering Economics.	
CLEMENT EDWARDS CHASE . . . . .	1916
The Cherry Street Bridge, Toledo, Ohio.	
FREDERICK WILLIAM SCHEIDENHELM . . . . .	1917
The Reconstruction of the Stony River Dam.	
ROSS MILTON RIEGEL . . . . .	1918
The Hydraulic Jump as a Means of Dissipating Energy.	

The Fuertes gold medals are of a value of fifty dollars each, and are awarded under the following conditions:

The undergraduate medal "will be awarded annually to that student of the College of Civil Engineering who may be found at the end of the first term of his senior year to have maintained the highest degree of scholarship in the subjects of his course; provided he has been in attendance in the University for at least one and one-half years."

The graduate medal "will be awarded annually to that graduate of the College of Civil Engineering who may write a meritorious paper upon some engineering subject tending to advance the scientific or practical interest of the Profession of the Civil Engineer."

The paper shall be presented on or before April 15. If a paper is presented in printed form, it will be received only provided it has not been published earlier than the preceding April 15.

## THE FUERTES MEMORIAL CONTEST IN PUBLIC SPEAKING

Through the generosity of Mr. C. H. Baker, a graduate of the College of Civil Engineering of the class of 1886, a fund has been created, the income of which is to be used to offer prizes in public speaking for students in the Colleges of Engineering and Architecture. The first prize is \$125, the second \$35 and the third \$20.

R. E. PIERCE, M.E. . . . .	1913	H. L. HOCK, C.E. . . . .	1916
H. B. POPE, C.E. . . . .	1914	L. V. LACY, B.Ar. . . . .	1917
A. M. BEEBEE, M.E. . . . .	1915	C. KU, M.E. . . . .	1918

# MEMBERS OF THE ASSOCIATION OF CIVIL ENGINEERS, CORNELL UNIVERSITY

*All graduates of the College of Civil Engineering up to and including 1919*

The home or permanent address is given on the line with the name, and the business or more temporary one on the line below. When only one is given its position is an index of its permanency, except when forced from one position to the other by lack of room. The addresses in italics are unreliable. All changes in address should be reported promptly to the Corresponding Secretary. The names of the deceased members are given at the end of the regular list.

Members who have been or are in military or naval service are indicated by a dagger, thus †.

Society Membership:

The Cornell Society of Civil Engineers of New York, an asterisk \*.

The American Society of Civil Engineers, Member, MASCE. Associate Member, AMASCE. Associate, AASCE. Junior, JASCE.

The American Railway Engineering Association, MAREA.

The American Society for Testing Materials, MASTM.

The Engineering Institute of Canada, Member, MEIC. Associate Member, AMEIC.

The Western Society of Engineers, MWSE.

The New England Waterworks Association, MNEWWA.

For membership in the other societies the names are similarly abbreviated.

Abbott, Clark D.....	CE '15	23 Bowers St Newtonville Mass
Real Estate		
*Ackhart, Andrew L .....	CE '11	AMSCE MAAAS 502 Best St Buffalo N Y
Chief Engr Eastern Conc Steel Co		402 D S Morgan Bldg
Adair, Arthur P. ....	BCE CE '99	MASTM 15 Chester St Allston P O
Civil Engineer Boston Mass		
†*Adams, Arthur .....	CE '01	MASCE 421A Lafayette Ave Brooklyn
Lieut Col U S A Ord Dept		1107 Broadway New York City [N Y
Adams, Morris H ..	BS in CE CE '09	Princess Anne Md
Secy Princess Anne Milling Co		
†Addams, William Jr .....	CE '17	502 E Pike St Cynthiana Ky
Grain Business		
†*Adee, Chester A .....	CE '12	1479 Metropolitan Ave Brooklyn N Y
1st Lieut U S R Engrs Base Hospital Camp Upton		N Y
*Adelson, Charles R .....	CE '15	Hancock N Y
Engrg Draftsman Bureau of Yards & Docks		Washington D C
Affeld, William C .....	CE '02	2725 Colfax Ave So Minneapolis Minn
Manager Albert Dickinson Co Seeds		

- \*Agate, Elroy T .....CE '97.....MAREA MEIC Pittsford N Y  
 Agcaoli, Romarico .....CE '08.....MPh Inst E & A Laoag Ilocos Norte P I  
 2d Asst to Director Public Works Manila P I  
 Aguilar, Juan E .....CE '08.....MCuSE Heredia alta 3 Santiago de Cuba  
 City Engr and Mem Firm Chalons & Aguilar Engrs and Contrs  
 †\*Aitchison, William M .....CE '12.....18 King St Morristown N J  
 Lieut U S A Const Div Aberdeen Proving Grounds Md  
 Alexander, Fred B .....CE '74.....606 California St Newtonville Mass  
 Rattan Mfrg 42 Everett St Allston Mass  
 Alexander, Henry D .....CE '93 MASCE MalbSCE 44 Terrace Ave Albany N Y  
 Sen Asst Engr Dept State Engr Barge Canal Office  
 Allen, G James .....CE '12.....823 25th St Newport News Va  
 Asst Suptdng Engr U S A Transport Service  
 †Allen, Gardner P .....BS in CE CE '16.....618 Church St Flint Mich  
 1st Lieut U S A Le Mans APO 762 France  
 Allen, Lawrence R. ....BS of CE CE '08.....Amity Ore  
 Farmer & Stockman  
 \*Allen, Myron A .....CE '14.....42 Spruceland Ave Springfield Mass  
 Estimator for Fred T Ley & Co Inc  
 †Allison, William F .....BS CE '04 MASCE 5264 19th Ave N E Seattle Wash  
 Major U S A Engrs France  
 \*Amidon, Edward B .....CE '13.....Marcellus N Y  
 Clerical Work Bur War Risk Ins Washington D C  
 †\*Anderson, James A .....CE '17.....Linden Va  
 Lieut Col U S A Q M C Hdq 7th Corps A E F France  
 \*Anderson, John D .....CE '10.....952 Greene Ave Brooklyn N Y  
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 Anderson, John K .....CE '12.....905 North Ave Wilkesburg Pa  
 Civil Engr Rust Engrg Co 504 Dist Nat Bank Bldg Washington D C  
 \*Anderson, Robert H .....CE '98.....AMASCE Sunnyburn Pa  
 Chief Engr Great Falls Development Tenn Power Co Parksville Tenn  
 †Anderson, William C .....CE '14 MME of N Y 662 Decatur St Brooklyn N Y  
 2d Lieut U S A Am Sec Toulouse Univ A E F France  
 Andrews, Don E .....CE '05.....330 So Main St South Bend Ind  
 Dir Tech Dept Holland Amer Pltn Kisaran Asahan Sumatra  
 Andrews, Harry S .....CE '15.....JASCE Fulton N Y  
 Br Desnr & Drftn Off Engr of Strs N Y C R R Co 540 Lexington Ave N Y C  
 †\*Antell, Tristan .....CE '13.....1116 Ocean Ave Brooklyn N Y  
 Statistician Hallgarten & Co 5 Nassau St New York City  
 \*Appel, Harris A .....CE '08.....New York City  
 Care Bruno Grosche & Co 90 Wall St  
 Armstrong, Alexander F .....CE '01.....MASCE 19 S Hawk St Albany N Y  
 Civil Engr and Bus Repr of the Atlantic Refining Co of Philadelphia Pa  
 Armstrong, John E .....CE '08.....AMEIC 2358 Hutchison St  
 Asst Engr Can Pac Ry Co 401 Windsor St Sta Montreal P Q Can  
 †\*Armstrong, Merwin .....CE '10.....AMASCE Fayetteville N Y  
 Arnold, Carter A .....CE '09.....Elberton Ga  
 Wholesale Grocer and Broker



- †Ashburner, Lesley . . . . . CE '06. . . . . MECI Ph 412 First St S E  
Civil Engr U S Navy Washintgon D C
- Ashby, Charles W . . . . . CE '93 . . . . . Box 190 R F D 4 Hampton Va  
Chargeman U S Naval Station Newport News Va
- †Ashley, F Carl . . . . . CE '05 . . . . . AMASCE Honeoye N Y  
Major U S A Engrs France
- †\*Ashton, Herbert . . . . . AB '11 CE '13 . . . . . 502 Cedar Lane Swarthmore Pa  
Sergeant U S A 20th Engrs Amer Sec Univ of Grenoble France
- †\*Atwood, William G . . . . . CE '92. . . . . MASCE MAREA  
Colonel U S A Engrs Am Tr Repr Supreme Economic Council Paris France
- Augenblick, Harry A . . . . . CE '10 LLB JD . . . . . 810 Broad St Newark N J  
Lawyer and Member of Assembly
- \*Auld, Robert J . . . . . CE '14 . . . . . Osborn Ave New Hartford N Y  
Aid U S Coast & Geod Survey Manila P I
- †\*Aull, Ludwig . . . . . CE '10 . . . . . 1425 John St Baltimore Md  
Engrs (U S A) France
- †Austin, Herbert A R . . . . . CE '13 . . . . . JASCE MHEA Wailuku Maui T H  
Asst Engr Div of Hydrog Commr of Public Lands Honolulu T H
- Austin, Herbert S . . . . . CE '07 . . . . . AMASCE R D 2-89 Poughkeepsie N Y  
Chief Engr Okla Pipe Line Co 216 No Twelfth St Muskogee Okla
- †Austin, Robert W . . . . . CE '12 . . . . . 612 Myrtle Ave Albany N Y  
Capt Engrs Asst Adj Gen A E F Paris France
- \*Avery, Fred H . . . . . CE '97 . . . . . MASCE 1453 Foster Ave Chicago Ill  
Engineer in Charge of Bridge Cons and Reprs City of Chicago
- Axtell, Harold A . . . . . CE '11 . . . . . Perry N Y  
Sales Engr Truscon Steel Co 314 Woodward Bldg Washington D C
- Ayres, C Morton . . . . . CE '94 . . . . . MASCE Box 392 Tuscaloosa Ala  
Chief Engineer Central Iron & Coal Co Holt Ala
- †\*Babcock, Maurice L . . . . . CE '11 . . . . . Scio N Y
- Bacharach, Abram F . . . . . CE '16 . . . . . 1734 W North Ave Baltimore Md  
Transitman L V R R Jersey City N J
- Bacon, Claude B . . . . . CE '05 . . . . .  
Mine Engr Moctezuma Copper Co Pilaes de Nacozari Sonora Mex
- \*Bacon, Ethelbert . . . . . CE '12 . . . . . 72 Highland Ave Buffalo N Y  
Asst Circ Mgr McGraw-Hill Pub Co New York City
- \*Bacon, George M . . . . . CE '93 . . . . . MASCE MNEWWA MUsCE  
Cons Engr 311 Newhouse Bldg Salt Lake City Utah
- Badger, Henry F Jr . . . . . CE '03 . . . . . 727 Edgemont Blvd Los Angeles Cal  
Engr Board Fire Underwriters of the Pac 214 Citizens Nat Bank Bldg
- Bailey, Earl B . . . . . CE '94 . . . . . 1228 Edward St Lakewood O  
Traveling Salesman
- Bailey, John D . . . . . CE '00 . . . . . 870 W Market St Lima O  
Chief Engr The Buckeye Pipe Line Co 137 W North St
- †\*Bailey, John S . . . . . CE '14 . . . . . 614 Madison Ave Montgomery Ala  
Corporal 47th Co 20th Engrs France
- Bain, Patterson Jr . . . . . BS in CE MCE '10 . . . . . MECISL 5727 Enright Ave St Louis Mo  
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- \*Baker, Charles H . . . . . CD '86 . . . . . MASCE MAIEE Mohegan Lake N Y  
Civil Engineer

- \*Baker, Clarence M. .... CE '08 MCE '16..... MAPubHA MA1bSCE  
Asst San Engr U S Pub Health Service Washington D C
- †Baker, Edwin S..... CE '15 ..... 502 W First St Oil City Pa  
Care Boldt Constr Co Genl Contrs 6110 Euclid Ave Cleveland Ohio
- \*Baker, Howard W ..... CE '86 ..... 431 McKnight Bldg Minneapolis Minn  
Retired Winters at Coronado Cal
- \*Balcom, H Gage ..... CE '97 ..... MASCE Hastings-on-Hudson N Y  
Cons Engr 10 E 47th St New York City
- \*Baldwin, Ernest H ..... CE '92..... MASCE 549 St Louis St Springfield Mo  
Asst Constr Engr Braden Copper Co Rancagua Chile
- †Ball, Ethan F ..... CE '14 JMESWPa 573 Hopkins St Buffalo N Y  
Asst Engr McClintic-Marshall Constr Co Pittsburgh Pa
- †Ballard, Wilson T..... CE '16 ..... 1622 Mt Royal Ave Baltimore Md  
1st Lieut U S A 305th Engrs France
- †Balser, Lewis F ..... CE '17..... 2520 N Sixth St Harrisburg Pa  
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Structural Engineer 26 Cortland St
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- \*Barbour, Irvin W ..... CE '94 ..... MMe S CE 28 Belknap St Woodsford Me  
Prin Asst Engr State Hwy Comm State House Augusta Me
- Bardol, Frank V E ..... CE '89 ..... MASCE 1256 Main St Buffalo N Y  
Engr & Contr 400 Morgan Bldg
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Asst Engr Off Chief Engr M W & S Southern Ry Charlotte N C
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- \*Barnhart, George D ..... CE '16 ..... Clayton N Y  
Computer Val Dept N Y C R R Gr Cent Term New York City
- †Baron, Edward V ..... BS CE '10 ..... AMASCE Kingsbury Cal  
Asst Engr U S Rec Ser Yakima Wash
- Barros, Carlos Paes de ..... CE '76 ..... MHInstSP Sao Paulo Brazil  
Coffee Planter & Pres Textile Co Rua Sa Ifigenia No 20
- \*Barton, Calvin L ..... CE '99 ..... MASCE New York City  
Engr and Contr McHarg-Barton Co 171 Madison Ave
- Barton, George T ..... CE '17 ..... Montour Falls N Y  
Asst to Cons Engr Harlan Plant Bethlehem Shipbldg Corp Wilmington Del
- \*Barzaghi, Arthur J ..... CE '10 ..... AMASCE Shippan Point Stamford Conn  
Eng Dept Turner Const Co of New York
- †Bassett, Harold R ..... CE '19 ..... 714 Dwight St Holyoke Mass
- †\*Bassett, Herbert H ..... CE '02 ..... MASCE 11 Iowa St Worcester Mass  
Major U S A Constr Q M U S Gen Hosp No 35 West Baden Ind

- \*Bassler, Robert E ..... CE '17 ..... 683 De Kalb Ave Brooklyn N Y  
Aero Mech Engr Bur Const & Rep Navy Dept Washington D C
- †\*Bates, Carl A ..... CE '13 ..... 15 Clyfton St Plymouth Mass  
Captain U S A 33d Engrs Camp Dodge Ia
- †Batjer, Henry H ..... CE '17 ..... Abilene Tex  
2d Lieut U S A 5th Engrs France
- Batley, Edward A ..... CE '15 ..... 72 Heartt Ave Cohoes N Y  
Hull Fmn Standard Shipbldg Corp 201 Myrtle Ave W Brighton N Y
- Battin, Henry W ..... CE '81 ..... 220 Ave F Billings Mont  
Bridge Constr Olympian Peninsula Wash
- \*Bauer, Charles F ..... CE '13 .....  
c/o T A Gillespie Co Runion N J
- Baughner, William H ..... CE '14 ..... 38 N Fulton Ave Baltimore Md
- †\*Baum, John A ..... BS in CE CE '05 ..... 42 Steuben St Crafton Pa  
Asst Engr Corps Penn Lines West 1013 Penn Ave Pittsburgh Pa
- \*von Bayer, August H ..... CE '00 ..... MASME MAIME 33 Walnut Ave  
Supt Semet Solvay Co Wheeling W Va
- \*Beahan, Willard ..... CE '78 ..... MASCE MAREA 2213 Bellfield Ave  
1st Asst Engr N Y C Lines W Rm 50 Lake Shore Bldg Cleveland O
- †Beale, Arthur W ..... CE '13 ..... 240 Rutgers St Rochester N Y  
Building Contractor
- †Beale, David ..... CE '17 ..... 133 Abbott Road Wellesley Hills Mass  
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Civil Engr & Surveyor
- \*Beardsley, James W ..... CE '91 MASCE MWSE Heights Court Apts Ithaca  
Asst Chief Engr Grand Canal Impvts Tientsin China [N Y
- †Bechel, Charles H ..... CE '15 ..... 2803 W Tuscarawas St Canton O  
2d Lieut U S A Field Art Camp Meade Md
- †\*Beck, Charles S ..... CE '17 ..... 5818 Wellesley Ave Pittsburgh Pa  
2d Lieut U S A Engrs Student English Univ
- Becker, Charton L ..... CE '88 ..... R D 1 Philadelphia Jefferson Co N Y
- \*Beckman, Carl T ..... CE '15 ..... 249 Main St Northampton Mass  
Wholesale Confectionery Business
- Bee, Charles E. .... AB MCE '15 ..... AMASCE Lebanon Springs N Y
- Beebe, Roscoe C. .... CE '92 M Emp Tec Cl 818 W Water St Elmira N Y  
Engr in Chg R R Details El Plant Am Bridge Co
- †Behrman, I Ellis ..... CE '10 ..... AMASCE 1121 Balto St Baltimore Md  
Major U S A 26th Engrs France
- †Beitz, William E ..... CE '13 ..... 316 W Center St Medina N Y  
Captain and Adjutant U S A First Field Art Fort Sill Okla
- Belden, Clifford H ..... CE '99 ..... 28 Nathan Hale St New London Conn  
V P & Gen Mgr E S Belden & Sons Inc 217 Laurel St Hartford Conn
- \*Belden, George A ..... CE '12 JASCE 119 W Oglethorpe Ave Savannah  
Architect Cent of Ga Ry [Ga
- Bell, Harold I ..... CE '05 ..... AMASCE 15 Clifford St Portland Me  
Mgr Br Off H P Cummings Const Co 409 Fidelity Bldg
- \*Bell, Nelson J ..... CE '04 ..... MECID 1014 Redfern Ave Dayton O  
Chief Engr Schenck & Williams Archts 908 Mutual Home Bldg

- †\*Bellinger, Lyle F ..... CE '87 ..... MASCE Navy Dept Washington D C  
Civil Engr U S N Rank of Commander U S Navy Yard Bremerton Wash
- Beltaire, Mark A Jr ..... CE '02 ..... 29 Lawrence Ave Detroit Mich  
Vice Pres Crittall Casement Window Co 685 Atwater E
- †Bemis, Lloyd E ..... CE '19 ..... 4318 Sheridan Road Chicago Ill
- †Bennett, Curtis B ..... CE '19 ..... 507 W Main St Richmond Ky
- †\*Bennett, Rowland K ..... CE '18 ..... Philadelphia Jefferson Co N Y
- \*Benson, Charles B ..... CE '17 ..... 9 Hillside Drive Yonkers N Y  
Transitman N Y State Rys Rochester N Y
- †\*Benson, Orville ..... CE '88 ..... MASCE Pequannock N J  
Major U S A Engrs France
- †Benson, Walter V ..... CE '17 ..... Chatham N Y  
Asst Instr Subm School U S N New London Conn
- Bent, Reginald W ..... CE '13 ..... Bentville N S  
Asst Engr Hydrog Survey Dept Naval Serv Ottawa Ont Can
- Berman, Herman ..... CE '18 ..... c/o Patent Office Washington D C
- †\*Bermel, Peter E ..... CE '15 ..... MASCE 450 Morris St Albany NY  
Captain U S A 303d Engrs France
- †Bernstein, Max ..... CE '16 ..... 2114 Atlantic Ave Brooklyn N Y  
Comdg Off Co I 36th Inf Camp Devens Mass
- \*Berry, Harry V W ..... CE '13 .....  
Bertolet, Hyman E ..... CE '99 ..... Oley Berks Co Pa  
Engineer
- Bertran, Juan M ..... CE '18 ..... Humacao P R  
Field Engrs Off B & O R R Baltimore Md
- \*Beye, John C ..... CE '83 MAREA MWeSE 1040 Washington Blvd  
With I C C Div of Val Chicago Ill [Oak Park Ill
- Bidgood, Carlos F ..... CE '14 ..... MAlbSCE 381 Myrtle Ave Albany N Y  
Insrpr Constr Dept Pub Works U S Navy Yard Washington D C
- \*Biele, Frederic J ..... CE '09 ..... 7622 Seventh Ave Brooklyn N Y  
Engr Estate Engrg Co Contr Engrs 30 Church St New York City
- \*Bilderbeck, George L ..... CE '06 ..... AMASCE MCnSCE Groton Conn  
Pres Bilderbeck & Langdon Inc Archts & Engrs New London Conn
- †\*Bird, Matthew M ..... BS CE '12 ..... MFES 223 E Garden St Pensacola Fla  
Captain U S A Engrs France
- \*Birkhahn, Jacques ..... CE '08 ..... 51 E 129th St New York City  
Asst Engr N Y State Pub Ser Comm 1st Dist 49 Lafayette St
- Birnbaum, Milton ..... CE '12 ..... 1031 So Boulevard New York City  
Drftn Div of Design N Y State Pub Ser Comm 1st Dist
- \*Birner, Isador, L ..... CE '10 ..... MAAE Rm 1320 29 Bdwy New York City  
With H S Ferguson Engrs 200 Fifth Ave
- Bisbee, Ben H ..... CE '01 MStEA Ill 3912 Vincennes Ave Chicago Ill  
Clark-Bisbee Co Contrs 175 W Jackson Blvd
- \*Bishop, Hubert K ..... CE '93 ..... MASCE Warsaw N Y  
Dist Engr Bur Public Roads Dept of Agr Washington D C
- \*Bissell, Frank E ..... CE '78 MCE '79 ..... MASCE MAREA 10515 Wilbur A Cleveland O  
Senior Civil Engr Div Val ICC Municipal Bldg Chattanooga Tenn
- \*Blake, Henry E ..... CE '73 ..... Elsmere N Y  
Asst Engr N Y State Hwy Dept 53 Lancaster St Albany N Y

- Blakeslee, C Albert . . . . . CE '03 . . . . . 110 W Front St Clearfield Pa  
Chief Engineer Jefferson Coal Co Coal Glen Pa
- Blanco-Morales, H . . . . . CE '15 . . . . . Santurce P R  
Asst Engr Empresa Constructora del Puerto Ceuta Africa
- \*Blatch, Nora S . . . . . CE '05 . . . . . 15 W 91st St New York City  
Pres N S Blatch Inc Engrs & Contrs 50 E 42d St
- Blaylock, John C . . . . . BCE CE '07 AMASCE MWeSE 230 Doyle Ct Wilmette Ill  
Blaylock & Knapp Engrs & Contrs 327 So LaSalle St Chicago Ill
- \*Blickman, Saul . . . . . CE '11 . . . . . 286 Ft Washington Ave New York City  
Mfr Metal Products and Specialties 199 Lafayette St
- †\*Blinn, Thomas W . . . . . CE '12 . . . . . 1402 E Marquette Road Chicago Ill  
Engr Semet Solvay Co Detroit Mich
- †Bliss, Clarence R . . . . . CE '11 . . . . . 89 Chestnut St N Adams Mass  
2d Lieut U S A 308th Engrs France
- †\*Blog, Leo . . . . . CE '15 . . . . . 1539 Hillside Ter Akron O  
Ind Engr Goodyear Tire & Rubber Co
- †Blundon, J Paul . . . . . CE '17 . . . . . Riverdale Md  
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- \*Bogert, Clinton L . . . . . CE '05 . . . . . AMASCE MME of N Y C  
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- Bruen, Frank . . . . . CE '78 . . . . . 69 Prospect St Bristol Conn  
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- †\*Crook, C Earl . . . . . *CE '16* . . . . . 317 So Penn St Wheeling W Va
- Crossette, Murray F . . . . . *CE '02* . . . . . MAIME 337 S Franklin St Chicago Ill  
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- \*Crossman, Ralph S . . . . . *CE '11* . . . . . Huntington N Y  
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- Crouch, N Seymour . . . . . *CE '90* . . . . . Williamsport Pa  
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- †\*Cudebec, Albert B . . . . . *CE '08* . . . . . MASCE  
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- †\*Cuff, James E . . . . . *CE '12* . . . . . 145 Flower Ave W Watertown N Y  
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- †\*Culbertson, William J . . . . . *CE '15* . . . . . 305 So Edgefield Ave Dallas Tex  
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- \*Cummin, Gaylord C . . . . . *CE '04* . . . . . AMASCE MAWWA 31 Bellevue Ave  
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- \*Cummin, Hart . . . . . *CE '09* . . . . . AMASCE 31 Bellevue Ave Dayton O  
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- †Cummings, Edward . . . . . *CE '17* . . . . . 2877 Briggs Ave New York City  
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- \*Cummings, Elmore D . . . . . *CE '89* . . . . . MASCE Indiana Pa  
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- \*Cummings, Noah . . . . . *CE '94* . . . . . AMASCE 625 W 127th St  
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- \*Diamant, Albert . . . . . CE '09 . . . . . Pine Hill N Y  
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- †Dickens, Wayland . . . . . CE '09 . . . . . MalbSCE Alpine N Y
- \*Dickinson, J Haines . . . . . CE '90 . . . . . Montclair N J  
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- †Dillard, William R . . . . . CE '17 . . . . . Washington Ga  
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- \*Dillenbeck, Clark . . . . . CE '88 . . . . . MASCE MECIPh Philadelphia Pa  
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- †Dimijian, Aran H . . . . . CE '18 . . . . . Ithaca N Y  
Master Engr Sen Gr U S A 419th Engrs France
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- †Douglas, P Gordon . . . . . CE '06 . . . . .  
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Str Steel Drftn Bur Yds & Docks Navy Dept
- \*Dubuis, John . . . . . *BA CE '09* . . . . . AMASCE MOrSE Grant's Pass Ore  
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- Dunlap, Arthur H . . . . . *BS of CE CE '99* . . . . . AMASCE Barstow Texas  
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Roadmaster Cent of Ga Ry Room 209 Term Sta Macon Ga
- \*Fitzpatrick, Frank T ..... *CE '15* .....432 W 51st St New York City  
Jun Asst N Y State Pub Ser Comm 1st Dist
- \*Fitz-Randolph, William S ..... *CE '05* .....AMASCE MAAAS Sloatsburg N Y  
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- †Flanigan, Horace C ..... *CE '12* .....Quaker Ridge New Rochelle N Y  
Ensign U S N R F U S Nav Av Det 1600 Harmon Pl Minneapolis Minn
- \*Fleming, Thomas Jr. . . *BS CE '05* .....MACSE MESWPa 648 Maryland Ave E  
Hyd and San Engr Chester & Fleming Union Bank Bldg Pittsburgh Pa
- †\*Fleming, Thomas J. .... *CE '13* .....29 Beacon St Waterbury Conn  
2d Lieut U S A 543d Engrs A E F France
- †\*Flynn, Walter F. J ..... *CE '12* .....Washington D C  
2d Lieut U S A Genl Engr Depot
- \*Foard, Arthur V..... *CE '06* AMASCE 1506 Linden Ave Baltimore Md  
Asst Supt Md Dredging & Contg Co Aberdeen Md
- Follansbee, Robert ..... *CE '02* .....AMASCE 403 P O Bldg Denver Colo  
Hydr Engr U S Geol Survey
- †Foote, Benjamin F ..... *AB '13 CE '16* .....28 Franklin Ave Lockport N Y  
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- Ford, Robert G ..... *CE '07* .....Bellwood Pa  
Supervisor Williamsport Div Penn R R Lock Haven Pa
- \*Forrest, Geo M ..... *BS CE '02* MASME MAAAS 129 Pierce St Easton Pa  
Gen Supt Ingersoll Rand Co
- \*Port, Edwin J ..... *CE MCE '94* .....MASCE MASTM MASMI  
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 Chief Estmr Fred T Ley & Co Inc Box 156 Mobile Ala  
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 Corporal U S A 29th Engrs Topog Div A P O 714 France  
 \*Foster, Thomas M. .... CE '04. .... 5659 Rosemary Pl New Orleans La  
 Asst Secy Louisiana Fire Prev Bureau 438 Barronne St  
 \*Foster, Willard S. .... CE '19. .... 161 Ridge Road Rutherford N J  
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 †\*Fowler, Charles H. .... CE '14. .... Little Falls N Y  
 Engr F T Ley & Co Inc c/o Elmer Fleet Corp Mobile Ala  
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 1st Lieut U S A Ord Dept Washington D C  
 \*Fox, Robert L. .... CE '09. .... 126 State St Batavia N Y  
 City Engineer Bethlehem Pa  
 \*Frank, Alfred. .... CE '98 MAIME Alta Club Salt Lake City Utah  
 Mining Engr & Pres Mining Cos 1101 Newhouse Bldg  
 †\*Frank, George S. .... CE '11. .... AMASCE 51 Park St Warsaw N Y  
 Captain American Food Admn Paris France  
 †Frank, Harry H. .... CE '12. .... 753 Mellon St Pittsburgh Pa  
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 Frank, Leslie C. .... CE '13 AMASCE MACHS 417 Raymond St  
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 Frieze, Edwin. .... CE '09. .... Catonsville Md  
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Capt U S A 34th Engrs A E F France [York City]
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- †\*Fulton, William J ..... *CE* '12..... Lytle Mont
- \*Gaffin, William W ..... *CE* '96.. MWeSE Fond du Lac Wis  
Gaffin & Gehri Engrs & Contrs 270 Sheboygan St
- Gage, Lloyd G ..... *CE* '02..... 834 W Granite St Butte Mont  
Civil and Mining Engineer
- \*Gallagher, Joseph ..... *CE* '07..... Myers N Y  
Asst Engr Mobile Shipbuilding Co Mobile Ala
- Gantz, Maurice A ..... *CE* '13..... Troy O  
County Surveyor Miami Co
- \*Garbi, Louis ..... *CE* '07 AEIC 5 Lincoln Ave Montreal P Q Can  
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- \*Garmezy, Samuel ..... *CE* '13... MECITr 1382 Prospect Ave N Y City  
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- †Garrett, Robert P ..... *CE* '97... MASCE MECStL 6234 Washington Ave  
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- †Garrett, Seymour S ..... *CE* '04. .... 130 Blair St Ithaca N Y  
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- †\*Gavett, Weston ..... *CE* '11 *MCE* '12 MACHS MAWWA 312 W 5th St Plainfield  
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- Gehring, Herbert A ..... *CE* '03..... AMASCE MAAAS Homer N Y  
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- Geibel, Edward M ..... *CE* '16. .... 144 Millbank Ave Greenwich Conn  
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- Gelder, Walter H ..... *CE* '98..... 704 E Montgomery Ave Ashland Ky  
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- Gelser, Charles S .....CE '03.....Dalton N Y  
Consulting Engineer
- \*George, Edward.....CE '75.....Nassau N P Bahamas B W I  
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- †George, Henry H 3d .....AB CE '12.....1831 Monument Ave Richmond Va
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Gen Mgr Getman Commercial Co Lonja 518 Havana Cuba
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- †Gibson, G Edward .....CE '03.....MAIbSCE Albany N Y  
Asst Engr State Engrs Off Telephone Bldg
- Gideon, Abraham .....CE '95.....MASCE MAWWA  
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- Gildea, Ray Y.....CE '12.....MECIbA 14 York Court Guilford Md  
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- †Gillette, Harold S .....CE '10.....MBiES 904 Press Bldg Binghamton N Y
- \*Gilmore, Alvin L .....CE '08.....AASCE Binghamton N Y  
Cons Engr and Vice-Pres Bing Bridge Co Inc Y M C A Bldg
- \*Gilmore, Harry W.....Ph B CE '01.....
- Giltner, Louis C .....CE '01.....Columbia Isle of Pines W I  
Cashier National Bank and Trust Co Nueva Gerona
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Sales Engr H H Robertson Co 447 So Rebecca St Pittsburgh Pa [Pa]
- \*Goepel, Frederick N .....CE '07.....Eighth St & Storer Ave Pelham N Y
- \*Goff, Albert L .....CE '11.....Elba Genesee Co N Y  
Drainage Engineer
- Golden, Harry E .....CE '91.....Myron St R F D 1 Schenectady N Y  
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- \*Goldstein, Hyman W.....CE '12.....1388 Eastern Parkway Brooklyn NY  
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- \*Goodman, Max .....CE '12.....1451 Prospect Ave New York City  
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 Manager Goodman Lumber Co
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 Co A 25th Engrs France
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- Gray, Edward T. . . . . CE '01. . . . . 126 Tioga St Johnstown Pa  
 Civil Engineer Cambria Steel Co
- †Gray, Joseph H. . . . . CE '17. . . . . Maine N Y  
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- Greeley, Dana S. . . . . CE '05 ME. . . . . Cotton Exch Bldg New York City  
 Traveling Manufacturers Representative in South America
- †\*Green, Charles N. . . . . CE '88. . . . . MASCE  
 Major U S A Engrs Constr Q M 7th & B Sts Washington D C
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 2d Lieut U S A Aberdeen Proving Grounds Aberdeen Md
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 Metallurgical and Mining Engr Pres U S Chem Copper Co
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- Greene, Wallace. . . . . CE '74. . . . . 2024 Hillyer Place N W Washington D C  
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- Greig, Robert S. . . . . CE '13. . . . . Eldred Sullivan Co N Y  
 Asst Supt Const Brookwood Farms Barryville N Y
- \*Gridley, Haines. . . . . CE '04. . . . . MAIME 113 Walnut St Elmira N Y  
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- Gridley, William G. . . . . CE '09. . . . . 106 E Chemung Place Elmira N Y  
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 Grime, John R ..... CE '15 ..... Cazenovia N Y  
 Asst Engr E I Du Pont Co Pompton Lakes N J
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 Draftsman Gas Dept Riter-Conley Mfg Leetsdale Pa
- Grossman, Joseph G ..... CE '12 ..... 699 W 133 St New York City  
 Machine Shop Auto Parts
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- Hankenson, John J . . . . . *BCEMCE* '94 . . . . . Glencoe Minn  
Railway Location and Construction
- Hanna, Elias S . . . . . *CE* '13 . . . . .
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- Highle, Lee ..... CE '97 ..... New Meadows Ida  
Banking
- Hilborn, Edwila ..... CE '91 ..... Port Leyden N Y  
Asst Engr Dept State Engr and Survr Waterford N Y
- Hilborn, William H ..... CE '10 ..... Phoenix N Y  
With Chester & Fleming U S Govt Housing Project Erie Pa
- \*Hildreth, Norman E ..... CE '09 c/o Fred T Ley & Co Inc Springfield Mass  
Engr Works Supply Dept F T Ley & Co Inc Mobile Ala
- Hill, Curtis ..... CE '97 MASCE 44 ..... E Concord Ave Kansas City Mo  
City Engineer
- †Hill, Harry W ..... CE '13 ..... 1503 N Caroline St Baltimore Md  
Captain U S A Engineers Gen'l Staff Washington D C
- Hill, John E ..... MS CE MCE '95 ..... MASCE FAAAS 86 Taber Ave  
Prof Civil Engrg Brown Univ Providence R I

- †\*Hill, Raymond C ..... CE '12. .... 553 E 24th St Paterson N J  
Hill, Theodore W ..... CE '93..... Bellefontaine O  
Contracting Engineer
- \*Hillemeier, Arthur ..... CE '09 ... 58 West Seventh St Mt Vernon N Y  
Civil Engineer
- †Hillman, Charles A ..... CE '17..... 1714 N H Ave N W Washington D C  
Hilpert, Meier G.....BS CE '01.....MASCE 211 Briggs St Harrisburg Pa  
Asst Engr Bethlehem Steel Bridge Corp Bethlehem Pa
- \*Hilton, Joseph C.....CE '96 AMASCE 1918 Cortelyou Rd Brooklyn N Y  
Contractor Mason Hilton & Co 120 Liberty St New York City
- \*Himes, Albert J.....CE '87.....MASCE MAREA 1640 E 117th St  
Valuation Engineer New York Chicago & St Louis R R Cleveland O
- †Himes, Albert P ..... CE '16..... 1640 E 117th St Cleveland O  
Private 2d San Sqdn 83d Div France
- \*Hinck, Frederick W ..... CE '10....MBRECI 359 E 25th St Brooklyn N Y  
Structural Designer Buchman & Kahn Arch 56 W 45th St New York City
- \*Hinks, Warren H ..... CE '12.....MJES Burke N Y  
Mem Firm & Chief Engr Fetterman Engrg Co Johnstown Pa
- \*Hirsch, Herman D ..... CE '10. ....1462 Park Place Brooklyn N Y  
Asst Engr American Bridge Co 30 Church St New York City
- †Hiscock, George S ..... CE '19.....Southampton N Y  
Hoard, Prescott D ..... CE '05.....140 Wadsworth Ave New York City  
Hobart, Charles B ..... CE '98..... 105 N Wissahickon Ave Ventnor N J  
Chief Engr Campeche-Laguna Corp Laguna del Carmen Campeche Mex
- †\*Hock, Harold L..... CE '16.....150 West Main St Middletown N Y  
1st Lieut U S A 2d Engrs 2d Div Germany
- Hoehn, Charles E.....CE '13..... Albany N Y  
Jun Engr N Y State Barge Canal
- Hoffeld, Henry R ..... CE '87..... Lancaster N Y  
Mem Firm R Hoffeld Co 65 Carroll St Buffalo N Y
- \*Hoffert, J Raymond ..... CE '11 .....MESPa 12 So 19th St Harrisburg Pa  
Civil Engineer
- †\*Hoffman, Charles A ..... CE '17 272' Herberton Ave Port Richmond N Y
- †\*Hofstader, Meyer ..... CE '13.....  
1st Lieut U S A 304th Engrs France
- Hogan, Joseph V ..... CE '08 AMASCE 224 Paddock St Watertown N Y  
6219 Delancey St Philadelphia Pa
- †Hoge, Philip B ..... CE '08..... Scottwood Apts Toledo O  
Asst Engr Inv & Report for C E Knoeppel & Co of 6 E 39th St New York City
- Holbrook, Roy B ..... CE '10.....23 Oxford Road Newton Center Mass  
Farmer Royal Ridge Farm Front Royal Va
- \*Holdredge, Earl B ..... CE '11..... Edmeston N Y  
Engrg Salesman Trussed Conc Steel Co 422 The Guerny Syracuse N Y
- †\*Holland, Franklin E ..... CE '12..... 4214 Western Ave Montreal P Q Can  
Lieut U S A 22d Engrs France
- \*Holloway, Arthur P ..... CE '07. .... 136 Sampson Ave Ingram Pa  
Asst Engr of Refractories H Koppers Co Pittsburgh Ea



- †\*Holloway, Henry F Jr ..... *CE* '15... 223 Upper Mountain Ave Montclair N J  
1st Lieut U S A 314th Field Art France
- \*Holmes, Edward ..... *CE* '05 ..... 2844 Rockwood Place Toledo O  
Terminal Engr Willys Overland Co
- Holmes, Edward B. .... *CE* '12..... 216 Main St Keene N H  
Mining Engr Rio de Janeiro Brazil c/o E J Lavino & Co Bullitt Bldg Phila Pa
- Holmes, Glenn D ..... *CE* '96 MASCE 204 W Kennedy St Syracuse N Y  
Chief Engr Intercepting Sewer Board 104 City Hall
- †\*Holmquist, Carl ..... *CE* '10..... 47 W 49th St New York City  
Chile Exploration Co
- \*Holzman, Jacob C ..... *CE* '10 MISME N Y 124 W 114th St New York City  
Civil Engineer
- \*Hooker, Elon H. *AB AM CE* '94 *PhD* '96..... 40 Wall St New York City  
President Hooker Electrochemical Co
- Hopkins, Cecil B ..... *CE* '07..... AMASCE San Francisco Cal  
Pacific Coast Manager Concrete Engr Co 301 Rialto Bldg
- †Hopkins, Frank S ..... *CE* '11 ..... 50 S Clinton St Poughkeepsie N Y
- Hopkins, Howard C. .... *CE* '03 ..... 2337 Fargo St Los Angeles Cal  
Civil Engineer
- Horner, George W ..... *CE* '73 ..... R D 2 Belmont N Y
- Horton, Albert H ..... *CE* '98 AMASCE MWaSE Silver Creek N Y  
Hydr Engr U S Geol Sur 1330 F St N W Washington D C
- \*Horton, Philip Z ..... *CE* '10 ..... AMASCE Peoria Ill  
Cons Engr Horton Engr Co 401 Cent Nat Bank Bldg
- Hou, C Y ..... *MCE* '19 ..... 31 Zan Ka Da Soochow China
- †Hough, Frederick W ..... *CE* '19 ..... Athens N Y
- †\*Hough, Lawrence C ..... *CE* '14 ..... East Falls Church Va
- \*Houston, Levin J Jr..... *AB CE* '01..... 602 Parkwyth Ave Baltimore Md  
City Manager Fredericksburg Va
- \*Howard, David A. .... *CE* '11. .... 3123 N St Washington D C  
Civil Engineer Army Medical School
- Howard, Thomas ..... *CE* '01..... Portland Conn..  
Asst Engr N Y S Hwy Comm Waddington St Law Co N Y
- \*Howe, Harry N. .... *CE* '04..... AMASCE Memphis Tenn  
Gardner & Howe Engrs 76 Porter Building
- †Howell, Charles J. .... *CE* '19 ..... 124 Seward Ave Auburn N Y
- \*Howell, Eric V ..... *CE* '14 *MCE* '18..... Southampton N Y  
Instructor in Civil Engrg Cornell Univ Ithaca N Y
- †\*Howland, Charles A. .... *CE* '12 MalbSE 1429 Belmont St N W Washington  
283 Huffson Ave Albany N Y [D C
- Howland, Rufus B ..... *CE* '72..... Trumansburg N Y  
Retired
- \*Hoy, William W ..... *CE* '95 ..... 816 French St Santa Ana Cal  
Street Superintendent & City Engr
- \*Hoyt, Herbert B ..... *CE* '09 ..... MAWPA 300 South Ave Bradford Pa  
Supt Timber Preserving Plant B R & P Ry Co
- \*Hoyt, John C ..... *CE* '97..... MASCE MWaSE Washington D C  
Hyd Engr in Charge Surface Waters Div U S Geol Survey

- †\*Hoyt, Raymond H ..... *CE* '15..... 180 Greyrock Place Stamford Conn  
Hoyt, William G ..... *CE* '09 AMASCE 4618 So Salina St Syracuse N Y  
District Engr Water Resources Branch U S G S Madison Wis  
Hsu, Yush S..... *CE MCE* '12..... *Tung Wu Col Soochow China*  
Asst Engr Canton Hankow Ry Changsha Hunan China  
Hu, Tung Chao ..... *BS in CE MCE* '05..... MChES *Shanghai China*  
Chief Tech Dept Nanking-Hunan Ry Nanking China  
Huang, Chia-Chi ..... *MCE* '18 MSSCh MChES c/o SY Tsu 22 E Yoa Chia  
Draftsman 500 Todd St Wilkesburg Ea Lung E Gate Shanghai China  
Huestis, Charles C ..... *AB CE* '92 AMASCE 647 E Seminary St Greencastle  
Pres & Gen Mgr Carbon Min Co Carbon Ind [Ind  
\*Hughes, Norman..... *AB CE* '10..... Jackson N C  
Manager H & W W Newhern Co Powells Point N C  
†Hulburt, Lucius S ..... *CE* '03..... AMASCE Brasher Falls N Y  
Div Engr Western Div Dept State Engr & Survr Rochester N Y  
\*Hulse, Shirley C ..... *CE* '02..... MASCE Bedford Pa  
†\*Hunkin, Samuel E ..... *CE* '17..... 17830 Lake Ave Cleveland O  
Const Supt Hunkin-Conkey Const Co  
†Hunt, Clinton S ..... *CE* '13..... 232 Chili Ave Rochester N Y  
\*Hunt, Guy H..... *CE* '08..... 13512 Fourth Ave E Cleveland O  
Instructor in Mechanics Case School Applied Science Cleveland O  
Hunt, Sidney E ..... *CE* '94..... Portlandville NY  
Minister Methodist Episcopal Church  
†Hurlbut, Hinman B ..... *CE* '01..... MASCE 3318 19th St N W  
Captain U S A Ord Dept 6th & B Sts N W Washington D C  
†Hurley, John P ..... *CE* '07..... AMASCE 8 Eighth Ave Brooklyn N Y  
Hurley, John W ..... *CE* '10..... 2012 Harbert Ave Memphis Tenn  
Jun Engr U S Engr Off Chg Revetment Const Porter Lake Ark  
\*Hutchison, James H..... *CE* '06..... 413 N Union St Olean N Y  
Res Engr E I Du Pont de Nemours & Co Box 282 Newark Del  
\*Hutson, Arthur C..... *BS CE* '05..... 140 N 16th St E Orange N J  
Off Engr Nat Board Fire Underwriters 76 William St New York City  
Hyatt, Edward K..... *CE* '10..... 7024 Washington Ave St Louis Mo  
Pres Taylor-Hyatt & Co Contrs  
Hyde, Alfred T ..... *CE* '73..... Lorton Va  
Const Cumberland Pipe Lines in Kentucky  
Hyde, Edward W..... *CE* '72 *MCE* '74..... MAAAS MMS MAIA  
Actuary Columbia Life Ins Co 814 Lincoln Ave Sta D Cincinnati O  
\*Hyde, Howard E ..... *CE* '00..... MASCE 302 W Seneca St Ithaca N Y  
Pres Young & Hyde Inc Contr Engrs Prod Exch Bldg New York City  
†Hyde, Richard L ..... *CE* '17..... JASCE 425 W 162d St New York City  
1st Lieut U S A Engrs Kings College Univ London England  
†\*Hynds, Harold D ..... *CE* '12..... AMASCE 115 Fenimore St Brooklyn NY  
Captain U S A Asst in charge Conc Ship Const 309 Pine St San Francisco Cal  
Icasiano, Abelardo R..... *CE* '17..... MAAE MCIES Bulacan Bulacan P I  
Asst Engr New York Chicago & St Louis R R Cleveland Ohio  
†\*Iglehart, Joseph A W..... *CE* '14..... 1406 Park Ave Baltimore Md  
Captain U S A 321st Field Art France

- †Infanger, Adolph O ..... CE '18.....90 Glen St Brooklyn N Y
- †Ingalls, Owen L ..... CE '86 MASCE 22 Morningside Ave New York  
Major U S A Engrs 139th Engrs Camp Shelby Miss [City
- †\*Ingalls, Robert D ..... CE '17.....Phelps N Y  
Captain U S A U S Engrs School Camp AA Humphreys Va
- \*Ingersoll, Vernon S ..... CE '98.....10 Scott Place Rockville Center N Y  
Civil Engineer
- Irving, James N ..... CE '11. AMASCE Arlington Hts Riverside Cal  
Asst Engr Quinton Code & Hill Cons Engrs Los Angeles Cal
- Irwin, A Charles..... BS MCE '16 ..... MAREA 4450 N Richmond St  
Asst Engr C M & St P Ry Chicago Ill
- \*Jackson, J Ceylon..... CE '15.....New Milford Pa  
Jun Engr U S Engr Dept First District New York City
- Jackson, Leon E ..... CE '10 ..... Greene N Y  
Engr Roch Ry & Lt Co Rochester N Y
- \*Jackson, William ..... CE '90 7417 Church Ave Ben Avon Pittsburgh Pa  
Engr American Bridge Co Ambridge Pa
- \*Jacobs, Robert H ..... CE '93. AMASCE 49 Lafayette St New York City  
Div Engr of Tracks N Y State Public Service Comm 1st Dist
- \*Jacoby, Hurlbut S. .... AB '08 CE '10 ..... AMASCE 1825 Mannering Road  
Secy & Chief Engr H K Ferguson Co 6523 Euclid Ave Cleveland O
- †\*James, Robert L ..... CE '12. JASCE MSPEE Box 27 Chapel Hill N C
- Janney, William H. .... CE '74 ..... 1815 N Charles St Baltimore Md
- \*Japhet, W Ernst. .... BS CE '08. .... 2600 Hopkins St Houston Tex  
Engineer Petroleum Refining Co
- †Jaret, Milton..... AB '13 CE '14..... 1957 85th St Brooklyn N Y
- Jarvis, George M..... CE '78..... 742 E Penn Ave San Antonio Tex
- Jenkinson, Richard D. .... CE '07..... 40 N Howard St Bellevue Pa  
Real Estate and Insurance
- \*Jennings, Louis C..... CE '10 ..... 135 Pelham St Newport R I  
Res Engr The Foundation Co Ltd St Jerome P Q Can
- \*Jenrick, Wm F ..... BS CE '10 ..... AMASCE 113 White St Waverly Mass  
Estimator Stone & Webster Engrg Corp 147 Milk St Boston Mass
- \*Johnson, Albert M ..... CE '95.....6353 Sheridan Road Chicago Ill  
Pres Nat Life Ins Co of U S A 29 So La Salle St
- Johnson, Albert T ..... CE '11.....923 N Madison Ave Peoria Ill  
Plant Engrg Great Western Electro-Chem Co Pittsburgh Cal
- †Johnson, C Reid ..... CE '13.....1424 Linden Ave Baltimore Md  
Lieut (jg) U S Navy Hampton Roads Va
- †Johnson, Donald S ..... CE '15.....Evanston Hotel Evanston Ill
- Johnson, Eugene C ..... CE '05. .... 686 Catalina St Los Angeles Cal  
Chief Engr Pac Elec Ry Co
- †\*Johnson, Harvey S ..... CE '11. .... JASCE 65 Sussex St Port Jervis N Y
- †Johnson, Hollister ..... CE '12. .... AMASCE Dryden N Y  
Captain U S A 116th Engrs [For] 40th Div A E F France

- †\*Johnson, James A .....CE '13..... Gainesville N Y  
2d Lieut U S A 1st Engrs France
- \*Johnson, Lawrence.....CE '01..... Collinsville Conn  
Civil Engineer
- \*Johnston, Clifford C.....CE '12.....26 Morningside Ave New York City  
Mgr Empire State Advertising Agency Albany N Y
- \*Johnston, Edgar .....CE '00.....733 Park Ave E Orange N J  
Secy & Treas Oakwood Ice Co 26 Oakwood Ave Orange N J
- †Johnston, Jesse C .....CE '13.....308 E Olive St Lamar Col  
Merchant
- †Johnston, Miles C. ....AB BS CE '12.....1411 Grove Ave Richmond Va  
Lieut U S A Air Ser France
- \*Johnston, William R Jr.....CE '05.....28 Yale St Maplewood N J  
Engr L V R R 143 Liberty St New York City
- †\*Jones, Bevan .....CE '06.....MASTM 174 W 89th St New York City
- †Jones, Harold H .....CE '10.....96 Norwood Ave Buffalo N Y  
1st Lieut U S A 52d Field Art France
- Jones, Jacob O. ....BS MCE '15.....MSPEE 1714 Indiana St Lawrence Kans  
Asst Prof Hydraulics Univ of Kansas
- †\*Jones, William M .....CE '18.....480 Convent Ave New York City
- Joseph, William B. ....CE '13.....1201 W Seventh St Wilmington Del
- Judson, David H .....CE '07.....71 W Cayuga St Oswego N Y  
Asst Engr Dept N Y S Engr & Survr Weighlock Bldg Syracuse N Y
- \*Justin, Joel D.....CE '06.....MASCE 743 Amherst St Buffalo N Y  
Res Engr Tallassee Power Co Badin N C
- Kain, Charles A .....CE '95.....418 Madison Ave N  
Struct Engr Aluminum Co of Amer Oliver Bldg Pittsburgh Pa
- \*Kalberg, S August .....CE '10.....AMASCE Springfield Mass  
Structural Engineer Fred T Ley & Co Inc
- Kampf, Louis .....CE '09.....33 Division St Norwich Conn  
Textile Engr Anderson Meyer & Co Tientsin China
- \*Kaufman, Abraham .....CE '15 c/o Dr A Isaacson 1477 Washington Ave  
[New York City]
- †\*Kaufmann, Ernst G .....CE '11.....AMASCE  
2d Lieut U S A Q M C Student England
- \*Kaufmann, Morris L .....CE '12.....918 E Parkway Brooklyn N Y  
Kaufman & Levine Cons & Ind Engrs 21 E 40th St New York City
- †Kaufman, Samuel.....CE '19.....1389 Stebbins Ave New York City
- †Keating, Thomas F Jr.....CE '17.....11 E 87th St New York City  
2d Lieut U S A Coast Art France
- \*Keays, Reginald H.....CE '95 AMASCE 2680 Hudson Blvd Jersey City  
Engineer-in-charge Degnon Contracting Co Allahan Ulster Co N Y [N J]
- Keeler, Louis V .....CE '13.....217 Jewett Ave Jersey City N J  
Field Secy The Rubber Assn of America 17 Battery Place New York
- \*Keenan, James N .....CE '09.....461 W 159th St New York City  
Dist Sales Mgr Aspromet Co 170 Broadway
- Kehler, Sherman I .....CE '94 MCE '03.....MAS Mar Drftn 157 V St N E  
Aero Engr Bureau Const & Rep Navy Dept Washington D C
- Kehoe, Harry .....CE '08.....161 E Third St Oswego N Y  
City Engr

- Kehrhahn, Charles J ..... *CE* '09.....MCIES 13600 Fourth Ave Cleveland O  
Asst Engr Dept Grade Crossing Elim N Y C & St L R R Co
- †\*Keller, Arthur R.....*CE*'03 AMASCE 2066 Lanihuli Dr Honolulu T H
- Kelley, Charles L ..... *CE* '85.....Main St Savannah N Y  
Civil Engineer
- \*Kelley, George B ..... *CE* '08.....1 Thirteenth St Upper Troy N Y  
Jun Engr N Y State Barge Canal
- \*Kelley, William D ..... *BS MCE* '81.....MASCE Long Island City N Y  
Pres Kelly & Kelley Engrs Bldrs & Contrs 12th St near Vernon Ave
- †Kellogg, George D ..... *CE* '07.....Greenwood N Y  
Asst Engr N Y State Engrs Dept Albany N Y
- \*Kelly, Edward De V ..... *CE* '10.....Oriskany NY
- †Kelly, Edward J Jr ..... *CE* '12.....61 W Erie Ave Corning N Y  
2d Lieut Engrs 856th Co Transportation Corps
- Kelsey, Clifford S.....*BA CE* '88 .....162 Remsen St Brooklyn N Y  
Vice-Pres Realty Associates
- Kelsey, Sidney E.....*CE* '87.....1824 Jefferson St Kansas City Mo
- \*Kendall, Charles H.....*CE* '95 *MS MASCE MAAAS MWaSE* 1501 College Ave  
U S Sen Hwy Engr Dist 6 501 Wheat Bldg Ft Worth Tex
- \*Kennedy, James C ..... *CE* '79.....Carson City Nev  
Res Engr State Highway Dept
- †\*Kerby, Charles K ..... *CE* '15.....40 Rugby Road Brooklyn N Y  
Sergeant U S A Co C 137th Engrs Serv Bttm France
- †\*Kerby, Russell T.....*CE* '13.....1019Kenmore Place Brooklyn N Y  
Captain U S A Inf 318th Mach Gun Bttm France
- Kessler, William ..... *CE* '13.....23 Ninth St Woodside N Y  
Asst Engr U S G S 328 Custom House San Francisco Cal
- †\*Kibbe, Harmon C.....*CE* '16.....2722 Ashby Ave Berkeley Cal  
2d Lieut U S A Engrs Camp Lee Va
- †Kidde, Reguar T ..... *CE* '13.....215 W 101st St New York City  
1st Lieut U S A 308th Inf France
- Kiddie, John ..... *CE* '04.....MAIME Morenci Ariz  
Div Mine Supt Arizona Copper Co
- Kiep, Henry A Jr ..... *CE* '10.....R F D 55 Westfield N J  
Ind Finance Dept Robertson Cole Co New York City
- Kimber, George F ..... *CE* '12.....570 Pennsylvania Ave Detroit Mich  
Chief Drftm Pere Marquette R R
- \*King, Alvin W ..... *CE* '07.....108 E Moreland Ave Chestnut Hill  
Sales Mgr Nelson Valve Co Philadelphia Pa
- †King, Clifford M .....*AB CE* '04.....AMASCE 111 Boalt St Sandusky O  
Captain U S A 313th Engrs Camp Dodge Ia
- \*King, Everett E.....*AB CE MCE* '11.....AMASCE MAREA Urbana Ill  
Professor Railway Civil Engrg University of Illinois
- \*King, Leon T ..... *CE* '10 ..... 20 James St Ilion N Y  
Jun Engr N Y State Barge Canal Herkimer N Y
- †King, Paul ..... *CE* '16.....Emporia Va  
1st Lieut U S A 32d Engrs France



- King, Tao ..... CE '12 JASCE 14 Yen Chia Hsiang Soochow China  
Res Mem Comm on Rwy Technics Ministry of Communications Peking China
- Kingsland, Lawrence D II ..... CE '17 ..... Hotel Beers St Louis Mo  
Captain Engrs Const Dept Red Cross c/o Am Exp Co Paris France
- Kinnear, Eugene C ..... CE '07 ..... 1882 Columbia Road Washington D C  
Senior Str Engr ICC Bur Val 731 Wells Fargo Bldg San Francisco Cal
- †Kipp, Frederick M Jr ..... CE '14 ..... JASCE 1732 N Payson St Baltimore Md  
2d Lieut U S A 33d Engrs France
- †Kirschner, Charles ..... CE '14 ..... JASCE 427 Fourth St Troy N Y  
Drain Engr Bur Pub Roads Dept of Agr New Orleans La
- †Klaber, John J ..... CE '06 ..... Sdes ArchDPLG 124 W 88th St N Y C
- Knapp, Frank H ..... CE '11 ..... AMASCE Blasdel N Y  
225 Park St Bridgeport Conn
- †Kneeland, Herbert D ..... CE '10 ..... MESWPa 5879 Darlington Road  
Asst Mgr United Engrg & Foundry Co 54th St Pittsburgh Pa
- Knight, Frederick J ..... CE '73 ..... Monroe Orange Co N Y  
Computer Intl Bdy Comm 719 15th St N W Washington D C
- \*Knighton, John A ..... CE '91 MASCE 207 W 107th St New York City  
Div Engr (Harlem River Div) Dept Pl & Str 2221 Madison Ave
- Knoch, Julius J ..... MS CE '92 ..... AMASCE Little Rock Ark  
Cons Engr Carter & Knoch 803-805 A O U W Bldg
- \*Knowlton, Robert H ..... CE '06 MNELA MAIEE 211 Cornell Av Swarth-  
Power Engr United Gas Improvement Co Philadelphia Pa [more Pa
- \*Koester, Edwin F ..... CE '13 ..... 807 West St Wilmington Del  
Engineer in Charge Surveying Dept
- Kohn, Arthur H ..... CE '06 ..... 21 N Lime St Lancaster Pa  
Bureau of Hwys 505 Eighth Ave Brooklyn N Y
- \*Kolberk, Andrew ..... CE '12 ..... 1411 Grand Blvd and Concourse  
Asst Engr I R T Co 165 Broadway New York City
- Koo, Nee Sun ..... MCE '19 ..... MESCh Nai Wai Shanghai China
- \*Koopman, Jacob ..... CE '13 ..... c/o Arthur McMullen Co New York City  
Engr with Arthur McMullen Co of New York Cheswick Pa
- †Korff, Harry O ..... CE '16 ..... 1720 W Lafayette Ave Baltimore Md
- \*Kornfeld, Harry ..... BS CE '11 ..... AMASCE 90 E 18th St Brooklyn N Y  
With Hugh L Cooper & Co 101 Park Ave New York City
- †Kraft, George L ..... CE '15 ..... MWaSCE 1730 1st St N W  
Captain U S A Gen'l Staff Washington D C
- Kramer, Edwin W ..... CE '06 ..... Missoula Mont  
Dist Hydro Elect Engr U S Forest Service 508 Montana Bldg
- Kratzenstein, Hugo ..... AB CE '04 ..... 7 E 94th St New York City  
Civil Engineer 152 W 88th St
- \*Krause, Alois W ..... CE '12 ..... 32 Matchett St Brighton Mass  
Secy Geo E Warren Co 35 Congress St Boston Mass
- †Krauss, John S ..... CE '17 ..... 974 St Nicholas Ave New York City  
Chief Machinist's Mate U S Navy
- †Kristal, Frank A ..... CE '08 ..... 1743 Jackson Ave Ann Arbor Mich  
419 So Belmont Ave Newark N J

- \*Kronberg, Sol ..... *AB CE '08* ..... 1225 49th St Brooklyn N Y  
Secy Supertone Talking Machine Co 18 W Twentieth St New York City
- \*Kruse, Otto V ..... *CE '09* ..... 126 Livingston St Buffalo N Y  
Plant Engr Oldbury Electro-Chem Co Niagara Falls N Y
- \*Krusi, Herman ..... *CE '82* ..... 2033 Central Ave Alameda Cal  
Retired
- Kuck, John F R ..... *BS CE '12* ..... 22 W Harris St Savannah Ga  
Asst Engr Cent of Ga Ry
- †Kurias, Max ..... *CE '18* ..... 801 Fifth St New York City  
Ensign U S Navy U S S Winding Gulf
- \*Kurtz, Ford ..... *CE '07* ..... J G W Engrg Corp 43 Ex Pl N Y C  
Res Engr J G White Engrg Corp Muscle Shoals Ala
- \*Kurz, Ernst W ..... *CE '17* ..... 38 Main St Tarrytown N Y  
2d Cl Seaman U S N R F 117 Waverly Place New York City
- LaBrequé, Henry F ..... *CE '07* ..... 126 Winthrop St Brooklyn N Y
- \*Lacazette, Alfred A ..... *CE '13* ..... ASME MCuSE Vedado Havana Cuba  
Civil & Mech Engr Calle 2 entre 9 y 11
- \*LaCroix, Arthur E ..... *CE '16* ..... Grandby Road So Hadley Falls Mass  
Res Engr Power Const Co 178 Lincoln St Worcester Mass
- Lahr, Charles ..... *CE '15* ..... 51 Chicago St Elmhurst N Y  
Jun Engr N Y State Pub Ser Comm 1st Dist New York City
- Lanahan, Howard G ..... *CE '09* ..... Laurel Md  
Supt of Const Hurley Mason Co 500 Equitable Bldg Tacoma Wash
- Lance, John H ..... *CE '96* ..... MASCE Kingston Pa  
Chief Engr Spring Brook Water Sup Co WilkesBarre Pa
- Lance, William L ..... *CE '08* ..... 462 Rutter Ave Kingston Pa  
Engrg Corps Spring Brook Water Sup Co WilkesBarre Pa
- Landa, Francisco ..... *CE '07* ..... MCuSE Paseo 194 Vedado  
Engr Insp Hay Elec Ry Light & Pow Co Havana Cuba
- \*Landis, Charles W ..... *CE '00* MABCoECI 14 Hamilton Ave Cranford NJ  
Contr Engr U S Steel Prod Co 30 Church St New York City
- Landon, Eugene A ..... *CE '80* ..... MASCE Groton N Y  
Secy and Treas Begent Lumber Co
- †Lane, Emory W ..... *CE '14* ..... JASCE 1038 Heath St Lafayette Ind  
Computer Maimi Conservancy Dist Box 138 Y M C A Dayton O
- \*Lanpher, Edwin E ..... *CE '99* ..... 540 Sheridan St Pittsburgh Pa  
Div Supt Bureau of Water
- Lara, Edward M ..... *CE '03* ..... Bend Ore  
Cashier First National Bank
- \*Larned, William H ..... *CE '84* ..... Haigler Neb  
Cashier State Bank of Haigler
- Lathrop, John P P ..... *CE '92* ..... MECI Ph Wayne Pa  
Civil Engineer and Contractor Overbrook Pa
- Latting, Benjamin F ..... *CE '94* ..... Care C H Latting Shortsville N Y  
Aero Engr Sig Corps U S Army 140 U St N E Washington D C
- Lau, Waau W ..... *AB '14 CE '15* ..... Tientsin China  
Asst Engr River Improvement Comm
- \*Lavine, I William ..... *CE '15* ..... 37 Lefferts Pl Richmond Hill N Y  
Civil Engineering

- †Lawrence, Frank E ..... CE '06..... AMASCE 415 W 36th St Savannah Ga  
Major U S A Engrs Amer Relief Adm Ragusa Dalmatia
- Lawrence, Theodore F ..... CE '88..... Chester N Y  
Cheese Manufacturer
- Lawson, David T ..... CE '73..... Valparaiso Chile S A  
Consulting Engineer
- Lay, Charles H ..... CE '74..... Oil City Pa  
Retired
- †Lazo, Antonio ..... CE '07..... 108 E 82d St New York City  
Mem Firm Bodell & Co Investment Bankers 120 Broadway
- \*Lechler, Bruno C ..... CE '08 LL B ..... 219 Kingsland Ave Brooklyn N Y  
Gen Mgr S S Hepworth Co 2 Rector St New York City
- Ledger, William H ..... BE MCE '95 ..... 393 New Canterbury Rd  
Asst Engr Sydney City Ry Dulwich Hills Sydney NSW
- \*Lee, A Carl ..... CE '10..... AMASCE  
Res Engr Water Power Co Lugoff S C
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- †Wright, Chilton A ..... CE '19.....22 Kress Park New Rochelle N Y  
Graduate Student Cornell University Ithaca N Y
- \*Wright, George C ..... CE '03.....MRoES 1609 Culver Rd Rochester N Y  
County Assistant Engineer
- †\*Wright, Harold B ..... CE '14.....5 Jewett Place Utica N Y  
Sergt U S A Co E 23d Engrs (Hwy) France
- Wright, Howard B ..... CE '15.....6038 Dorchester Ave Chicgo Ill  
Assistant Estimating Department Sinclair Refining Co
- Wright, Thomas T ..... BA CE '07.....AMASCE Warsaw Va  
Henrico Lumber Co
- \*Wyckoff, Maurice M ..... CE '12.....AMASCE 246 Rochester Ave Brooklyn  
Purchasing Agent T A Gillespie Loading Co So Amboy N J [N Y
- Wyckoff, Ralph F ..... CE '08.....1946 Ivar St Hollywood Cal  
Mem of Firm Rooney-Wyckoff Co Paving Contrs 607 So Hill St Los Angeles Cal
- Yen, Hoong-Kwie ..... MCE '19 MSSCh MESCh East St Han-Shan Shien  
[Anhui China
- Yewell, J Edward ..... CE '12.....533 N Milton Ave Baltimore Md  
Chief Draftsman B & L E R R Greenville Pa
- \*Young, Henry A ..... CE '99.....MASCE 10 Myrtle Ave Maplewood N J  
Mgr Young & Hyde Inc Contrs Prod Exch Bldg New York City
- Young, Nathan E ..... CE '01.....123 W Main St Union N Y  
Road Contractor Jeffersonville N Y

- Yzaguirre, Salvador M. .... CE '10. .... MASCE  
Dist Engr Cuba Cane Sugar Corp Central Stewart Canal Co Cuba
- †Zabel, Oscar E F. .... CE '15. .... 118 Clifford Ave Rochester N Y  
Engineering Department Taylor Instrument Co
- Zabel, William J. .... CE '14. .... MROES 118 Clifford Ave Rochester N Y  
Assistant Engineer N Y S Barge Canal Off
- \*Zagoren, Lewis I. .... CE '14. .... 2408 Clarendon Road Brooklyn N Y  
Designer & Estimator Trusson Steel Co New York City
- †\*Zambrana, José A. .... CE '15. .... Juana Diaz P R  
Asst Civil Engr Fajardo Sugar Co Fajardo P R
- †Zander, Roy J. .... CE '17. .... 2014 Sheffield Ave Chicago Ill
- Zarbell, Elmer. .... CE '95. .... MASCE 2080 Sherwood Ave Louisville  
Assistant to Chief Engineer L & N R R Co [Ky]
- Zee, Nai-Zung. .... MICE '19 MSSCh MESCh 331 Peking Rd Shanghai  
[China]
- †\*Zieget, Julius .... CE '10. .... 422 W Franklin St Baltimore Md  
Lieutenant U S N R F Ex Off Sect Base Cape May N J
- Zolzer, Charles H. .... CE '01. .... 9 Whittier St E Orange N J  
Engr and Sales Mgr Electro- Chem Sup & Eng Co Philadelphia Pa

## GEOGRAPHICAL LIST

### NORTH AMERICA

CANADA. Total 19.

ALBERTA.

Edmonton.—H. H. Tripp. Taber.—F. E. Elwood.

BRITISH COLUMBIA.

Vancouver.—R. E. Marvin.

MANITOBA.

Winnipeg.—J. G. Sullivan.

NEW BRUNSWICK.

Moncton.—C. B. Brown, Jr.

NOVA SCOTIA.

Truro.—F. M. Dawson.

ONTARIO.

Nobel.—M. W. Turner. Ottawa.—R. W. Bent. Sarnia.—E. A. Duschak.  
Sault Ste. Marie.—W. F. Munnikhuysen. Toronto.—G. G. Robinson.

QUEBEC.

Montreal.—J. E. Armstrong, L. Garbi, Jr., O. H. Linton, R. A. Lockerby, H. R. Lordly, N. B. Reardon, G. G. Underhill. St. Jerome.—L. C. Jennings.

MEXICO. Total 4.

Laguna del Carmen.—C. B. Hobart. Merida, Yucatan.—J. Bracho. Mexico City.—F. G. Palacio. Pilares de Nacozari.—C. B. Bacon.

### UNITED STATES

ALABAMA. Total 18.

Bay Minette.—W. W. Olney. Birmingham.—A. C. Decker, E. F. Hettrick, H. A. Powell, R. A. Smallman, J. DeW. Willcox. Holt.—C. M. Ayres. Mobile.—R. W. Clark, F. G. Foster, C. H. Fowler, J. Gallagher, N. E. Hildreth, E. J. Nelson, R. E. Swinney. Montgomery.—A. L. Smith. Muscle Shoals.—F. Kurtz. Sheffield.—L. H. Delany. University.—G. J. Davis, Jr.

ALASKA. Total 1.

Juneau.—G. H. Canfield.

ARIZONA. Total 1.

Morenci.—J. Kiddie.

ARKANSAS. Total 3.

Little Rock.—J. J. Knoch. Porter Lake.—J. W. Hurley. Prairie Grove.—R. D. Bogart.

**CALIFORNIA. Total 56.**

**Alameda.** H. Krusi. **Bakersfield.** F. W. Warthorn. **Berkeley.** E. C. Fortier, W. F. Martin. **Camp Fremont.** J. A. Buck, W. S. Dole. **Colusa.** J. M. Felkenor. **Coranada.** H. W. Baker. **East Auburn.** H. Grady. **El Centro.** L. Griffin. **Hollywood.** B. N. Moss. **Los Angeles.** H. F. Baker, J. P. C. Booth, C. J. Burnham, H. W. Dennis, H. C. Hopkins, J. N. Irving, F. C. Johnson, G. G. Macklish, O. A. Wait, R. F. Wyckoff. **Napa.** E. C. Murphy. **Oakland.** B. J. Finch. **Oroville.** V. R. Stirling. **Palo Alto.** C. D. Mars. **Pasadena.** D. J. Maphier on. **Pisttburgh.** A. T. Johnson. **Redlands.** L. P. C. Rockwell **Fields.** C. Heidt. **Sacramento.** W. F. Fairman, B. O'Connor, C. W. Raymond. **San Francisco.** I. J. Gay, M. Pave, E. Buryea, Jr., F. F. Hall, C. B. Hopson, H. D. Hynds, W. Kessler, E. C. Kincaid, N. B. Lucernone, C. H. Lavenant, G. T. Morri, V. H. Post, L. P. Raynor, A. V. Sahli, D. D. Sprague, H. W. Taylor. **San Pedro.** J. W. Ludlow, E. C. Stone. **Santa Ana.** W. W. Hoy. **Sierra Madre.** G. F. Ferris. **Stanford University.** J. C. L. Felt. **Stockton.** C. M. Weber. **Watsonville.** P. Ollason. **Wilmington.** P. W. Porter.

**COLORADO. Total 16.**

**Denver.**—P. Bain, Jr., F. E. Burton, F. H. Burton, C. W. Comstock, M. F. Crossette, R. Follansbee, W. E. Greenawalt, J. S. Longwell, T. H. Old, H. K. Runnette, J. J. Stahl. **Fort Morgan.**—J. H. Stubbs. **Georgetown.**—F. A. Maxwell **Lamar.**—J. C. Johnston. **Silverton.**—J. Dyson. **Telluride.**—J. A. Boshard.

**CONNECTICUT. Total 23.**

**Bridgeport.**—F. H. Knapp, J. M. Phillips, F. C. Wolfe. **Bristol.**—F. Bruen **Collinsville.** L. Johnson. **Hartford.** C. H. Belden, R. E. Curtiss, G. W. Dean, J. H. Ehlers, G. W. Penfield. **Middletown.**—E. T. McDowell. **New Haven.**—M. L. Carey, F. S. O'Reilly, E. J. Pearson. **New London.**—W. V. Benson, G. L. Bilderbeck, A. G. Cadiz. **Norwich.** H. L. Griswold. **Riverside.**—D. A. Dalton **Stamford.**—A. J. Barzaghi, R. H. Hoyt. **Wallingford.** A. Underhill. **Waterbury.**—W. C. McCrone.

**DELAWARE. Total 9.**

**Fort Du Pont.** S. H. Smith. **Newark.**—J. H. Hutchinson. **Wilmington.**—G. T. Barton, F. W. Carpenter, J. H. Courtney, W. B. Joseph, E. F. Koester, W. E. Price, M. A. Spamer.

**DISTRICT OF COLUMBIA. Total 73.**

**Washington.**—C. R. Adelson, E. B. Anndon, J. K. Anderson, L. Ashlamer, H. A. Axtell, C. M. Baker, R. E. Bassler, H. Berman, C. F. Bidgood, H. K. Bishop, F. C. Brandes, I. C. Brower, R. D. Brown, R. L. Burwell, C. C. Carpenter, F. W. H. Clay, H. T. Cory, A. B. Cozzens, E. D. Cummings, L. B. Curry, W. E. Dickinson, J. Duba, E. J. Duffies, A. C. Dunn, H. S. Fairbank, O. W. Ferguson, C. W. Fitch, W. F. J. Flynn, C. J. Fox, L. C. Frank, J. Fruchtlum, C. N. Green, W. Greene, W. G. Guss, J. R. Haswell, H. W. Hill, C. A. Hillman, A. H. Horton, D. A. Howard, J. C. Hoyt, H. B. Hurlbut, S. I. Kehler, F. J. Knight, G. L. Kraft, B. F. Latting, R. Levy, P. B.

Lum, J. Michaclson, B. C. Michelson, A. C. Minnix, J. H. Morgan, J. W. Morton, H. T. Munn, W. R. Ourand, D. Perlman, A. H. Place, P. Ploss, A. B. Quinton, Jr., P. Remsen, M. S. Rich, G. P. Ritter, F. W. Scheidenhelm, W. T. Spivey, M. Steljes, H. Stidham, C. A. Stott, Clarence H. Swick, C. M. Thiele, V. G. Thomassen, E. D. Thompson, C. L. Todd, B. B. Weiss, P. A. Welker.

#### FLORIDA. Total 8.

Austin.—G. Wollenweber. **Cocoanut Grove.**—R. M. DeGarino. **Jacksonville.**—D. G. Douglas, A. F. Perry, Jr. **Oveido.**—T. L. Mead. **Pensacola.**—C. D. Livant. **Stuart.**—H. Thomas. **Tampa.**—G. D. Curtis.

#### GEORGIA. Total 11.

Atlanta.—R. J. Taylor, P. F. Whittier. **Columbus.**—J. E. Craig. **Elberton.**—C. A. Arnold. **Macon.**—J. M. Fitzgerald. **Savannah.**—G. A. Belden, J. F. R. Kuck, J. L. Ober, N. Sherwood, W. M. Torrance, G. O. Wagner.

#### HAWAII. Total 9.

Hilo.—R. W. Hendry. **Honolulu.**—H. A. R. Austin, W. J. Collet, A. R. Keller, G. Nakamoto. **Maui.**—D. W. Townsend. **Schofield Barracks.**—P. V. Hanf, A. L. Marks, J. D. Pratt.

#### IDAHO. Total 7.

Boise.—E. Hedden. **Gooding.**—C. N. Seagrave. **Jerome.**—L. Crandall. **King Hill.**—E. C. Panton. **Lewiston.**—E. Thompson. **New Meadows.**—L. Highly. **Rupert.**—E. A. Finkelnburg.

#### ILLINOIS. Total 55.

Alton.—F. W. Olin. **Aurora.**—A. J. Love. **Camp Grant.**—J. E. Hayden. **Chicago.**—F. H. Avery, L. E. Bemis, J. C. Beye, B. H. Bisbee, J. C. Blaylock, C. M. Briggs, F. T. Connor, F. S. Constans, P. D. Coons, H. S. Dow, L. D. Emmert, L. Falkenau, N. C. Farr, R. L. Gifford, D. E. Hannan, A. C. Irwin, A. M. Johnson, N. A. MacLeod, G. H. S. McNair, J. W. Martin, W. J. Maver, H. Parsons, C. T. Seipp, O. J. Sewell, M. E. Shire, P. Strang, P. D. Van Vliet, A. K. Webster, F. M. White, W. A. White, R. B. Wilcox, H. B. Wright, R. J. Zander. **Danville.**—B. J. Woodbury. **Decatur.**—R. D. Wood. **Evanston.**—J. F. Hayford, D. S. Johnson. **Flora.**—C. G. Stewart. **Galesburg.**—W. B. Throop. **Harvey.**—G. Schirmer. **Joliet.**—F. H. Masters. **Madison.**—M. S. Darrow, O. M. Severson. **Mattoon.**—E. A. Chandler. **Minonk.**—C. R. Goodrich. **Oak Park.**—S. N. Williams. **Park Ridge.**—C. E. Mollard. **Peoria.**—P. Z. Horton. **Rockford.**—A. E. Rutledge. **Rock Island.**—V. A. Stilbolt. **Urbana.**—E. E. King.

#### INDIANA. Total 11.

Anderson.—L. A. Mitchell. **Carbon.**—C. C. Huestis. **Chalmers.**—S. L. Chaffee. **Elwood.**—P. L. Maher. **Gary.**—H. O. Egeberg. **Indianapolis.**—C. A. Thompson. **Lafayette.**—W. K. Hatt. **Rensselaer.**—E. D. Nesbit. **South Bend.**—D. Moomaw. **Union City.**—H. P. McKown. **West Baden.**—H. H. Bascett.



**IOWA. Total 13.**

Ames.—A. Marston. Atlantic.—H. S. Williams. Belle Plaine.—C. H. Bowen. Camp Dodge.—C. A. Bates, C. M. King. Cedar Rapids.—E. P. Boynton, T. R. Warrimer. Charles City.—A. B. Rider. Council Bluffs.—S. L. Etnyre. Davenport.—O. F. Priester, W. A. Priester. Des Moines.—D. S. Craig, D. M. Rounds.

**KANSAS. Total 4.**

Independence.—C. R. Weidner. Kansas City.—C. Clark. Lawrence.—J. O. Jones. Wichita.—R. H. Lockwood.

**KENTUCKY. Total 9.**

Ashland.—W. H. Gelder, F. H. Rayfield. Camp Knox.—L. L. Graham. Camp Taylor.—H. F. Porter. Cynthiana.—W. Addams, Jr. Louisville.—O. M. Clark, E. Zarbell. Richmond.—C. B. Bennett. Winchester.—J. M. Slater.

**LOUISIANA. Total 5.**

New Orleans.—O. F. Briede, Jr., T. M. Foster, C. Kirschner, C. W. J. Neville, O. Riess.

**MAINE. Total 5.**

Augusta.—I. W. Barbour. Ft. McKinley.—R. D. Burdick. Kittery Point.—N. November. Portland.—H. I. Bell, E. W. Gehring.

**MARYLAND. Total 49.**

Aberdeen.—W. M. Aitchison. A. V. Foard, J. L. Green. Baltimore.—W. H. Baugher, J. M. Bertran, J. P. Bonner, H. A. Brainerd, L. M. Brooks, H. G. Campbell, C. P. Cannon, G. A. Chase, Jr., W. A. Dehuff, E. Friese, R. Y. Gildea, W. S. Graham, J. E. Harn, E. Heubeck, W. H. Janney, H. O. Korff, C. H. Li, C. A. Mengers, W. M. Price, R. F. Proctor, S. Purcell, C. J. Rasch, G. J. Requardt, O. L. Rhodes, A. Silverman, B. L. Smith, H. E. Smith, J. W. Smith, J. A. Stalfort, H. C. Tompkins, W. W. Troxell, C. H. Walker, F. B. Whitman, G. F. Wieghardt. Camp Meade.—C. H. Bechel, C. H. Bunn. Chesterton.—M. deK. Smith, Jr. Colgate.—T. C. Schaetzle. Frederick.—R. E. Toms. Hagerstown.—W. E. Brooks. McDaniel.—W. P. Daly. Princess Anne.—M. H. Adams. Riverdale.—J. R. Whelpley. Seat Pleasant.—F. R. Nitchie. Sparrows Point.—R. Schlegel, D. B. Stewart, Jr.

**MASSACHUSETTS. Total 31.**

Attleboro.—W. I. Tuttle. Boston.—A. P. Adair, T. F. Bowes, R. W. Chase, E. J. Hadley, C. W. Haefner, Jr., L. Hart, W. F. Jenrick, A. W. Krause, A. R. Melior, C. Phillips, C. W. Sherman, C. B. Wheelock, J. S. White. Cambridge.—F. Ohrt. Camp Devens.—M. Bernstein, G. E. Parker, E. L. Smith. Ft. Banks.—J. A. Dittrich. Holyoke.—H. R. Bassett. Newtonville.—C. D. Abbott, F. B. Alexander. Northampton.—C. T. Beckman. Pittsfield.—H. J. Noble. Quincey.—J. P. Bright. Springfield.—M. A. Allen, L. R. Gons, S. A. Kalberg, H. R. Seely. Worcester.—A. A. Conger, A. E. La Croix.

**MICHIGAN. Total 17.**

**Battle Creek.**—C. D. Murray. **Detroit.**—M. A. Beltaire, T. W. Blinn, G. I. Finley, W. J. Graves, G. F. Kimber, M. S. MacDiarmid, F. N. Menefee, H. K. Morgans, E. H. Owen, B. S. Page, C. Schwartz, R. F. Shreve, S. Weiss. **E. Lansing.**—H. A. Gehring, B. K. Philp, H. K. Vedder.

**MINNESOTA. Total 12.**

**Duluth.**—T. D. Merrill. **Glencoe.**—J. J. Hankenson. **Minneapolis.**—W. C. Affeld, H. T. Eddy, H. C. Flannigan, C. A. Gould, H. G. MacDonald, W. C. Smith, S. L. Taylor, A. M. Thompson. **St. Paul.**—W. E. Bramhall. **Witoka.**—E. C. Nesbit.

**MISSISSIPPI. Total 1.**

**Camp Shelby.**—O. E. Ingalls.

**MISSOURI. Total 17.**

**Columbia.**—E. J. McCaustland, T. J. Rodhouse. **Hannibal.**—G. A. Brown. **Kansas City.**—R. L. Elton, C. Hill, S. E. Kelsey, W. T. Scaritt, C. B. Spencer. **St. Louis.**—W. R. Bright, R. S. Colnon, G. Devin, H. L. Erisman, R. P. Garrett, E. K. Hyatt, W. F. Leschen, L. Winship. **Springfield.**—G. E. Wilson.

**MONTANA. Total 9.**

**Billings.**—E. M. Sneckenberger. **Bozeman.**—L. D. Conkling, L. A. Cowan. **Butte.**—L. G. Gage, E. J. Strasburger. **Harve.**—H. R. Meyer, Jr. **Helena.**—R. F. Edwards. **Lytle.**—W. J. Fulton. **Missoula.**—E. W. Kramer.

**NEBRASKA. Total 7.**

**Fort Omaha.**—D. H. Ham. **Haigler.**—W. H. Larned. **Lincoln.**—A. S. Mirick. **Morrill.**—R. A. See. **Omaha.**—W. B. Clift, F. S. Selby, J. W. Towle.

**NEVADA. Total 1.**

**Carson City.**—J. C. Kennedy.

**NEW HAMPSHIRE. Total 3.**

**Nashua.**—W. F. Farmer, E. A. MacKrell. **Peterborough.**—F. Phillips.

**NEW JERSEY. Total 47.**

**Atlantic City.**—M. Grossman. **Caldwell.**—I. R. Riker. **Camden.**—G. F. Buckman, H. Ridgway, J. K. Van Campen. **Camp Dix.**—R. Booth, E. W. Doehler. **Camp Merritt.**—J. J. Hayes. **Cape May.**—H. D. Lott, J. A. Silsbee, J. Zieget. **East Orange.**—H. W. Butts, J. P. Churchill, S. B. Mambert, A. P. Reiter, A. L. Trimpi. **Elizabeth.**—P. H. Budd. **Harrison.**—E. W. Hall. **Hoboken.**—H. L. Moeller. **Jersey City.**—A. F. Bacharach, C. R. Meissner, H. B. Polak. **Newark.**—H. A. Augenblick, E. Clawans, F. A. Kristal, G. E. Lund, H. G. Miller, A. O. Nisenson, H. J. Patterson. **Orange.**—E. Johnston. **Passaic.**—D. Y. Dinom, P. Morris. G. P. Spear, Jr. **Paterson.**—R. C. Hill. **Plainfield.**—C. G. Williams. **Pompton Lakes.**—J. R. Grime. **Runion.**—C. F. Bauer. **Rutherford.**—W. S. Foster. **South Amboy.**—E. A. Evans, A. E. Frosch, M. W. Wyckoff. **South Orange.**—J. W. Heller. **Trenton.**—C. H. Capen, H. T. Critchlow, J. E. Elliott. **West Orange.**—H. M. Freeman. **Woodbury.**—W. MacVeagh.

**NEW MEXICO. Total 1.**

Santa Fe. F. Herrman.

**NEW YORK. Total 577.**

**Albany.**—H. D. Alexander, A. F. Armstrong, H. E. Blake, E. D. Burkart, W. E. Conklin, D. H. Daley, A. E. Drake, F. S. Dunn, G. W. Ellis, J. C. Finch, S. E. Fitch, G. E. Gibson, H. E. Hayes, C. E. Hoehn, C. A. Howland, C. C. Johnston, G. D. Kellogg, F. H. Macy, L. Miscall, A. H. Perkins, L. S. Rickard, G. S. Tompkins, C. O. W. Ulrich, C. R. Vanneman, E. H. Wells, Jr., F. P. Williams. **Allahen.**—R. H. Keays. **Alpine.**—W. Dickens. **Amsterdam.**—A. P. Mussi. **Angelica.**—H. S. Wilgus. **Astoria.**—G. R. Thompson. **Athens.**—F. W. Hough. **Auburn.**—C. J. Howell, J. J. Tehan, L. Weindling. **Baldwinsville.**—W. S. Saxton. **Barryville.**—R. S. Greig. **Belmont.**—C. W. Horner. **Belvidere.**—W. Brown. **Binghamton.**—C. F. deClerq, H. S. Gillette, A. L. Gilmore, H. S. Griswold, C. S. Mallery, J. S. Mallery. **Brooklyn.**—H. Bobker, L. M. Burt, H. S. de Camp, D. S. Carswell, A. Cohen, A. L. Colsten, J. A. Cooper, Jr., A. J. Fancher, N. M. Fischer, J. E. Fisher, F. J. Herr, J. P. Hurley, A. O. Infanger, M. Jaret, C. S. Kelsey, A. H. Kohn, H. F. La Brique, A. B. Meyer, R. S. Palmer, D. H. Picker, J. J. Quinn, J. E. Rosenthal, D. H. Sanders, W. B. Scheckel, H. Schindler, V. B. Seaman, S. S. Shipman, J. Sobel, S. H. Stebbins, W. R. Taylor, R. R. Upjohn, M. A. Valderrama, B. Wich, B. L. Wood. **Buffalo.**—A. L. Ackhart, F. V. E. Bardol, R. M. Bowman, L. A. Brown, W. H. Burgard, F. W. Crane, T. F. Danforth, L. L. Davis, A. J. Dillenbeck, W. H. Dunham, W. S. Farrington, J. J. Gromfine, G. W. Hewitt, H. R. Hoffeld, W. W. Lehrbach, H. E. Lindberg, J. H. Lynch, Jr., T. H. McKaig, H. N. Metzger, S. Names, G. H. Norton, A. B. Osborne, A. J. Pratt, E. G. Speyer, P. L. Sullivan, R. Y. Thatcher, J. E. Thebaud, N. O. Tiffany, Jr., G. F. Unger, A. J. Whitney, F. K. Wing. **Camillus.**—R. E. Weber. **Campbell Hall.**—R. Waldo. **Camp Upton.**—C. A. Adee, H. F. Bronson, G. P. Donnellan. **Canandaigua.**—G. W. Powell, P. T. Wheeler, J. P. Brownell. **Castile.**—C. S. De Golyer. **Champlain.**—W. A. Spelman. **Chatham.**—W. P. Boright. **Chester.**—T. F. Lawrence. **Clayton.**—J. W. Fitzgerald, J. H. O'Leary. **Clifton Springs.**—C. S. Thatcher. **Cohoes.**—E. Hayes. **Corning.**—E. J. Kelly, Jr., S. L. Tuttle. **Cuba.**—C. W. Wasson. **Dalton.**—C. S. Gelser. **East Hampton.**—N. N. Tiffany. **East Islip.**—I. Walzer. **Elba.**—A. L. Goff. **Elmira.**—R. C. Beebee, E. E. Thompson, Jr., O. C. Vieweg, S. E. Whitney. **Elmira Hts.**—C. C. Vosburgh. **Fayetteville.**—M. Armstrong. **Firthcliffe.**—H. F. Chadeayne. **Flushing.**—H. L. Goodwin, A. U. Whitson. **Forrest Hills.**—F. D. Sprague. **Fort Hamilton.**—A. Lyle, Jr. **Ft. Plain.**—E. D. Hendricks. **Garden City.**—W. E. Grafman, H. H. Hemmings. **Geneseo.**—E. R. Stapley. **Glens Falls.**—C. D. Farlin. **Gloversville.**—H. W. Fear. **Goshen.**—E. M. Vincent. **Gouverneur.**—W. H. Loomis. **Groton.**—J. Conger, Jr., L. J. Conger, E. A. Landon. **Herkimer.**—L. T. King, D. B. Rasbach. **Holley.**—J. R. Rogers. **Hornell.**—J. L. Gibbs, K. F. Thompson, L. H. M. Whitney. **Hudson.**—C. G. Rossman. **Islip.**—E. R. Smith. **Ithaca.**—F. A. Barnes, E. N. Burrows, E. D. Button, I. P. Church, J. Conley, W. L. Conwell, W. R. Cornell, C. Crandall, C. E. Curtis, E. A. Dahmen, D. G. Davis, A. L. Dittmar, H. J. Feehan, S. S. Garrett, S. G. George, E. E. Haskell, A. P. Herman, E. V. Howell, R. Luchetti, W. G. McClintock, J. C. McCurdy, H. V. Miles, H. N. Ogden, C. M. Pendleton, F. F. Pino, Jr., E. W. Schoder, W. F. Summers, E. T. Turner, P. H. Underwood, L. C. Urquhart, C. L. Walker, A. A. Ward, P. S. Wilson, C. A. Wright.

**Jamestown.**—E. W. Sellstrom. **Jeffersonville.**—N. E. Young. **Kingston.**—H. D. Darrow. **Lancaster.**—G. H. Rekate. **Lebanon Springs.**—C. E. Bee. **Leeds.**—W. R. Vedder. **Long Island City.**—A. W. Barbour, J. Piddian. **Lyons.**—F. W. Madigan, J. A. Sloat. **McGrawville.**—M. C. Bean. **Macedon.**—A. R. Bullis. **Malone.**—R. E. MacGregor. **Manchester.**—C. E. Smith. **Marathon.**—H. E. Mack. **Martinsville.**—D. L. Cownie. **Milbrook.**—A. H. Haight. **Mineola.**—C. H. Watson. **Mohegan Lake.**—C. H. Baker. **Monticello.**—M. G. Cohen. **Mt. Vernon.**—A. Hillemeier, F. K. Perkins, W. W. Reynolds, D. M. Robinson. **Newburgh.**—J. B. Whipple. **New York City.**—A. Adams, J. D. Anderson, H. S. Andrews, T. Antell, H. A. Appel, E. Bacon, H. G. Balcom, R. V. Banta, G. D. Barnhart, C. L. Barton, D. Beale, F. J. Biele, J. Birkhahn, M. Birnbaum, I. L. Birner, N. S. Blatch, S. Blickman, C. L. Bogert, J. A. Boorstein, W. L. Bowman, A. S. Brainard, F. H. Branim, J. C. Brigham, I. Brimberg, L. M. Brockway, E. Brooks, M. W. Brower, J. W. Brown, M. E. Brown, T. B. Bryson, E. D. Burnell, J. D. Burrage, J. P. Carlin, A. H. Chandler, C. E. Chase, W. Y. Cho, C. M. Chuckrow, A. E. Clark, T. S. Clark, A. Clunan, Jr., P. Cohen, S. Cohen, J. Condon, H. G. Conger, H. Corbin, A. S. Crane, G. C. Cummin, N. Cumings, L. B. Custer, B. C. Dailey, J. W. Daly, W. J. Darrow, M. A. Darville, J. M. Demarest, R. C. Dennett, J. H. Denniston, J. H. Dickinson, D. H. Dixon, J. F. Driscoll, W. S. Edge, J. H. Edwards, B. Ehle, A. C. Ehrlich, O. M. Eidlitz, I. J. Elkind, A. R. Ellis, C. Eppler, Jr., N. C. Fassett, C. A. Faucher, P. Fein, L. Feldman, M. Fellman, N. R. Finkelstein, E. W. Firth, F. T. Fitzpatrick, W. S. Fitz-Randolph, G. Fowler, A. M. Fox, E. A. Fraser, J. B. French, J. Fuchs, J. H. Fuertes, D. F. Fulton, R. W. Gastmeyer, J. C. Gebhard, H. W. Goldstein, M. Goodman, J. H. Gray, D. S. Greeley, C. Greene, J. G. Grossman, S. W. Haas, V. F. Hammel, C. R. Harding, J. S. Harris, A. S. Harrison, G. Harrison, R. W. Havens, J. C. Hilton, F. W. Hinck, H. D. Hirsh, P. D. Hoard, C. Holmquist, J. C. Holzman, E. H. Hooker, A. C. Hutson, H. E. Hyde, J. C. Jackson, R. H. Jacobs, W. R. Johnston, B. Jones, W. M. Jones, A. Kaufman, M. L. Kaufmann, S. Kaufman, L. V. Keeler, J. N. Keenan, W. D. Kelley, H. A. Kiep, Jr., J. J. Klaber, J. A. Knighton, A. Kolberk, H. Kornfeld, H. Kratzenstein, J. S. Krauss, S. Kronberg, M. Kurcias, E. W. Kurz, C. Lahr, C. W. Landis, A. Lazo, Jr., B. C. Lechler, K. Lee, C. H. Lent, S. Lessin, H. P. Levine, R. Lewis, S. B. Lindau, E. B. Lovell, A. B. Lueder, I. W. McConnell, L. McHarg, W. J. McKee, M. D. Mann, C. W. Marsh, P. F. Maxon, H. W. Maynard, A. W. Mellen, C. W. Meyers, C. W. Middleton, T. A. Monaghan, E. J. Moore, F. C. Moore, K. P. Moore, W. H. Morris, G. F. Mueden, S. Nagler, W. E. Natanson, H. G. Northrup, A. S. Nye, F. B. O'Connor, C. E. O'Rourke, G. Paaswell, R. Paulus, S. L. Peebles, C. N. Pinco, G. E. Pistor, Jr., B. Pologe, C. Potts, C. U. Powell, S. M. Purdy, J. E. Read, J. W. Reed, A. S. Regula, C. S. Rindsfoos, J. W. Ripley, F. J. Root, S. Rosenzweig, R. C. St. John, W. L. Savacool, R. F. Schaefer, W. H. Schmidt, A. F. Schreiner, D. H. Seaman, H. A. Seeley, E. E. Seeleye, M. K. Sessler, W. K. Shaw, W. F. Sherwood, S. C. Shing, L. O. Shipman, L. J. Sieling, F. W. Skinner, M. A. Smith, C. A. Snider, H. H. Snyder, P. E. Soman, H. G. Specht, C. C. Sprigg, H. R. Standiford, R. B. Stanton, A. K. Starkweather, J. Stearns, W. H. Stratton, L. Swerdlove, J. S. Swindells, J. W. Taussig, S. P. Thomas, A. Thomson, Jr., F. M. Towl, W. E. Truesdell, E. A. Truran, J. D. Tuller, A. L. Van Sicken, E. Viertels, F. Vieweg, Jr., J. E. Wadsworth, G. E. Waesche, B. H. Wait, J. C. Wait, S. J. Walzer, F. S. Washburn, H. E. Weatherlow, J. R. Webb, N. Weidberg, V. H. Werner, J. P. Whiskeman, F. C. Wight, C. G. Wigley, C. B. Wigton, H. H. Williams, R. B. Williams, Jr., N. T. Wood, H. A. Young, L. I. Zagoren.

**Niagara Falls.**—E. J. Fort, O. V. Kruse, D. A. Mackenzie, W. W. Read, W. L. Squire. **North Rose.**—A. Weed. **North Tonawanda.**—S. E. Dockstader, L. R. Smith. **Norwich.**—E. R. Davis, R. S. Wait. **Ogdensburg.**—C. H. Lord. **Olean.**—G. L. Purdy, G. O. Walhauser. **Oneonta.**—F. M. Gurney. **Oriskany.**—E. DeV. Kelly. **Ossining.**—R. A. Philipson. **Oswego.**—H. Kehoe, C. W. Linsley, F. W. Ormsby, C. H. Snyder. **Peekskill.**—J. B. Egbert. **Pelham.**—F. N. Goepel. **Philadelphia.**—C. L. Becker, R. K. Bennett. **Pittsford.**—E. T. Agate, P. Macy. **Plattsburg.**—A. W. Winship. **Pope's Mills.**—H. G. Turner. **Port Chester.**—Frank Cesario, V. J. Pacello. **Port Jefferson.**—E. T. Rummele. **Port Jervis.**—H. S. Johnson. **Portlandville.**—S. E. Hunt. **Port Richmond.**—C. A. Hoffman. **Poughkeepsie.**—F. S. Hopkins, G. L. Nickerson, J. H. Sturdevant. **Richmond Hill.**—P. N. Daniels, C. E. Gruner, I. W. Lavine, J. H. McClure. **Rochester.**—A. W. Beale, C. B. Benson, C. W. Brown, L. R. Brown, N. A. Brown, F. P. Cartwright, J. T. Child, E. R. Crofts, C. W. Curtis, F. L. Dodgson, C. F. Fisher, F. W. Fisher, F. F. Gordon, L. S. Hulburd, C. S. Hunt, L. E. Jackson, S. Levine, A. M. Moss crop, O. J. Pierce, J. O. Preston, J. W. Routh, A. K. Shumway, J. F. Skinner, C. F. Starr, W. R. Storey, R. C. D. Tempest, H. O. Thweatt, C. P. Utz, A. S. Whitbeck, W. N. Whitney, G. C. Wright, O. E. F. Zabel, W. J. Zabel. **Rockville Center.**—V. S. Ingersoll. **Savannah.**—C. L. Kelley. **Schenectady.**—H. E. Golden, R. Mayhew. **Scio.**—M. L. Babcock. **Seneca Falls.**—H. C. Smith. **Setauket.**—J. W. Wells. **Southampton.**—G. S. Hiscock. **Stanley.**—G. G. Smith, Jr. **Syracuse.**—W. M. Butler, J. E. Cuff, A. P. Haney, E. B. Holdredge, G. D. Holmes, D. H. Judson, F. A. J. Mack, M. B. Palmer, W. M. Reck, H. G. Throop, B. E. Tilton, T. McE. Vickers, J. H. Weidman. **Tonawanda.**—I. C. Chan. **Troy.**—W. E. Conklin, G. B. Kelley, T. M. Stuart. **Trumansburg.**—R. B. Howland. **Utica.**—V. W. W. Loomis, H. V. Owens, A. S. Patrick, H. L. Pitner. **Waddington.**—T. Howard. **Warsaw.**—H. Gouinlock. **Waterford.**—E. Hilborn. **Watertown.**—L. B. Cleveland, W. J. Durkan, F. A. Haley, A. R. Reilly, G. F. Healy, P. B. Sutton, R. L. White. **Watervliet.**—W. Stone. **Wellsville.**—F. L. Rockwell. **West Brighton.**—E. A. Batley. **West Webster.**—C. C. Cooman. **White Plains.**—H. C. Henderson. **Yonkers.**—A. F. Stolz.

#### NORTH CAROLINA. Total 12.

**Badin.**—J. D. Justin. **Chapel Hill.**—R. L. James. **Charlotte.**—W. H. Barnard, Jr., L. V. Edwards, I. Fried. **Durham.**—J. G. C. Christie. **Fairfield.**—J. S. Mann. **New Bern.**—H. A. Patten. **Powells Point.**—N. Hughes. **Randleman.**—I. C. Poole. **Wilmington.**—G. C. Borst, W. C. Spiker.

#### OHIO. Total 63.

**Akron.**—L. Blog, R. C. Edmunds, O. R. Elting, G. E. McCurdy. **Bellefontaine.**—T. W. Hill. **Cincinnati.**—A. W. Fuchs, E. W. Hyde, E. Marx, G. W. Rapp, L. G. Schreiber, C. M. Stegner. **Cleveland.**—E. S. Baker, W. Beahan, J. J. Chamberlain, Jr., C. H. Clark, I. C. Clausz, F. S. Hales, E. E. Hart, W. L. Havens, A. J. Himes, S. E. Hunkin, G. H. Hunt, A. R. Icasiano, H. S. Jacoby, C. J. Kehrhaan, C. J. Paterson, H. B. Pearse, L. A. Rodenheiser, G. A. Sarstedt, J. C. F. Shafer, J. A. Skinner, H. W. Strong, M. Warner, S. W. Webb. **Collinwood.**—L. P. Tier. **Columbus.**—R. H. Simpson, D. O. Stone. **Dayton.**—N. J. Bell, A. G. F. Buehler, H. Cummin, B. G. Danis, E. W. Lane, R. M. Riegel, J. H. T. Riley. **East Liverpool.**—G. L.



Hendrickson. **Elyria**.—J. B. Thomas. **Hamilton**.—C. H. Fahy. **Ironton**.—F. C. Tomlinson. **Lakewood**.—E. B. Bailey. **Lima**.—J. D. Bailey, W. G. Harger. **Portsmouth**.—A. T. Fay. **Toledo**.—R. B. Daudt, P. B. Hoge, E. Holmes, A. B. Loomis, J. R. McCarthy, C. P. Rhynus, W. J. Sherman. **Troy**.—M. A. Gantz. **Warren**.—A. M. Long. **Youngstown**.—A. G. McHugh, W. C. H. Ramage.

#### OKLAHOMA. Total 6.

**Fort Sill**.—W. E. Beitz, B. W. Brodt. **Muskogee**.—H. S. Austin, M. A. Earl. **Oklahoma City**.—W. Mackintosh, T. W. Taylor.

#### OREGON. Total 9.

**Amity**.—L. R. Allen. **Bend**.—E. M. Lara. **Eugene**.—J. W. McArthur, C. A. McClain. **Grant's Pass**.—J. Dubuis. **Newport**.—W. P. Stewart. **Portland**.—E. S. Healy, P. L. Heslop. **Vale**.—J. H. Lewis.

#### PENNSYLVANIA. Total 172.

**Ambridge**.—J. E. Banks, W. Jackson, J. S. Stone. **Ardmore**.—A. M. Taylor. **Beaver Falls**.—T. S. White. **Eedford**.—S. C. Hulse. **Bellevue**.—R. D. Jenkinson. **Bethlehem**.—R. L. Fox, M. G. Hilpert. **Bradford**.—H. B. Hoyt. **Charleroi**.—J. A. Piersol. **Cheswick**.—J. Koopman. **Clairton**.—T. Cosgrove, Jr., H. B. Stevens. **Coal Glen**.—C. A. Blakeslee. **East Mauch Chunk**.—W. Twining. **Easton**.—G. M. Forrest, A. H. Fuller, H. M. Spandau. **Edwardsville**.—J. O. Price. **Elizabeth**.—C. F. Eilenberger. **Emsworth**.—W. C. Thomas. **Erie**.—W. H. Hilborn, H. D. Oglesby, S. L. Super. **Forty Fort**.—T. L. Smith. **Franklin**.—C. F. Hamilton. **Glenolden**.—George Miller. **Greenville**.—E. E. Haslam, L. Spalding, J. E. Yewell. **Grove City**.—A. E. Maltby. **Harrisburg**.—R. J. Feeris, J. R. Hoffert. **Haysville**.—A. W. Dann. **Hazleton**.—L. H. Ryman, H. Wistrich. **Hazlewood Station**.—W. D. Clark. **Hog Island**.—E. R. Bowerman, H. M. Boyajohn, C. W. Diefendorf, J. L. Dodge, T. Dransfield, Jr., W. F. Heise, F. E. Hertel, H. M. Nelson. **Johnstown**.—G. C. Brown, E. T. Gray, W. H. Hinks. **Kingston**.—G. E. Long, D. M. Rosser. **Lebanon**.—L. S. Rhodes. **Leetsdale**.—M. Gross. **Lester**.—J. Goldstein, R. B. Mildon. **Lock Haven**.—R. G. Ford. **Markleton**.—J. P. Redwood. **Meadville**.—L. H. Edwards. **Mechanicsburg**.—E. E. R. Dornbach. **Monongahela**.—J. G. McCormick. **Newcastle**.—G. Curtis. **Oil City**.—C. H. Lay, H. B. Robinson, M. W. Robinson, G. F. Roess, W. C. Trumbull, B. B. Weber. **Oley**.—H. E. Bertolet. **Overbrook**.—J. P. P. Lathrop. **Palmerton**.—W. E. Nussbaum. **Philadelphia**.—G. B. Canaga, C. W. Collins, C. Dillenbeck, R. R. Fernow, C. W. L. Filkins, W. Fisher, W. H. Fitz, Jr., W. Gibb, R. T. Guilbert, J. F. Hardecker, M. Haupt, E. J. Hedden, T. R. Henderson, J. V. Hogan, A. W. King, R. H. Knowlton, E. P. Leonard, W. McKeever, C. L. Maas, T. Martin, Jr., J. J. Montgomery, C. H. Niemeyer, R. A. Pendergrass, C. M. Reppert, L. Robartes, F. Schoff, S. Schwartz, L. J. Smith, A. L. Stevenson, G. W. Supplee, M. A. Tenny, J. C. Trautwine, 3d, H. W. Underwood, J. A. Vogelson, D. W. Weaver, E. M. Wilson, C. H. Zolzer. **Phoenixville**.—H. R. Eyrich, T. C. Rogers. **Pittsburgh**.—E. F. Ball, J. A. Baum, John W. Brown, P. D. Brown, G. P. Buchanan, G. P. Bullard, G. W. Case, H. C. Chiu, A. Curry, A. E. Duckham, A. W. Engel, T. Fleming, Jr., B. F. Foote, R. L. Glouse, P. W. Haggart, E. D. Harsbarger, A. P. Holloway, C. A. Kain, H. D. Kneeland, E. E. Lanpher, Edmund Lynch, R. W. McKinstry, D. P. Maxwell, E. J. Mershon, B. McC. Miller,

J. N. Ostrom, G. E. Rickard, N. Schein, R. E. J. Summers, R. C. Taylor, C. L. Wilcox. Plymouth.—W. P. Davenport. Pottstown.—C. H. Mallison, F. P. Schleppi. Punxsutawny.—R. B. Wick. Ridley Park.—S. P. Hall. Scranton.—C. G. Brooks, H. F. Cox, W. G. Gridley, T. R. Williams. Sellersville.—B. J. O'Rourke, F. H. O'Rourke. Sewickley.—F. Terrazas. Swarthmore.—R. P. Green, S. B. Lilly, J. H. Miner. Swissvale.—T. Mao. Tyrone.—A. V. Vanneman. Uniontown.—W. O. White. Warren.—A. Rogers. Wilkesbarre.—C. L. Hartwell, J. H. Lance, W. L. Lance, J. F. Storz, J. S. Williams. Wilkesburg.—A. S. Collins, N. Dinnerstein, C. C. Huang, E. R. McMillin. Williamsport.—N. S. Crouch. Wyalusing.—C. L. Taylor. Wysox.—G. D. Woodruff. York.—D. A. Smith.

**RHODE ISLAND. Total 4.**

Manville.—W. I. Vose. Newport.—G. F. Whitney. Pawtucket.—J. W. Griswold. Providence.—J. E. Hill.

**SOUTH CAROLINA. Total 10.**

Charleston.—J. H. Dingle, H. G. Lehrbach, C. B. Moore, E. U. Ragland. Clemson College.—R. S. Crossman. Columbia.—E. L. Filby. Florence.—D. B. Packard. Lugoff.—A. C. Lee, C. T. Wanzer. Ninety Six.—D. T. Duncan.

**TENNESSEE. Total 13.**

Chattanooga.—F. E. Bissel, L. B. Bryan, C. S. Davis, P. S. Monk, R. I. Poole. Edenwold.—E. G. Edwards. Knoxville.—N. W. Dougherty. Memphis.—C. E. Davis, H. M. Howe, E. F. E. Schmied, T. R. Stockdale. Nashville.—W. H. Hanchett, C. H. Olmstead. Parkesville.—R. H. Anderson.

**TEXAS. Total 34.**

Austin.—V. M. Ehlers. Barron Field.—E. G. Bolger. Barstow.—A. H. Dunlap. Camp Baker.—S. J. Leonard. Camp Bowie.—H. Ryon. Cleburne.—T. P. Rollow, Jr. College Station.—J. C. Nagle, T. R. Spence. Corsicana.—W. H. Page. Ellington Field.—A. W. Harrington. El Paso.—F. W. Conant, A. L. Hawley. Fort Bliss.—C. A. Lyerly, Jr. Fort Sam Houston.—W. C. Conger. Fort Worth.—C. H. Kendall, D. L. Lewis, J. T. Nash, K. Robey, E. F. E. Schmidt, C. L. Wilson. Houston.—J. Cochran, H. H. Conway, J. L. Dowling, W. E. Japhet, H. B. Robinson, Jr., O. S. Van De Mark. Matagorda.—B. L. Hall. San Antonio.—R. J. Harding, G. M. Jarvis, T. U. Taylor. Taliaferro Field.—L. E. Pierce. Trinity.—H. H. Thompson. Waco.—E. L. Burnham, J. K. Rose, Jr.

**UTAH. Total 5.**

Logan.—R. B. West. Salt Lake City.—G. M. Bacon, A. Frank, R. R. Lyman, G. Sterling.

**VERMONT. Total 1.**

Rutland.—J. G. Shillinger.

**VIRGINIA.—Total 37.**

Alatvista.—G. C. Stone. Camp Eustis.—W. J. Culbertson. Camp Humphreys.—R. B. Carson, W. G. Distler, E. L. Hartman, R. D. Ingalls, C. C. More, W. O. Muench, Jr. Camp Lee.—H. C. Kibbe. Danville.—M. R. Watson. East Falls

**Church.**—L. C. Hough. **Fort Monroe.**—M. A. Feiner, A. C. Rountree. **Fredericksburg.**—L. J. Houston. **Front Royal.**—R. B. Holbrook. **Hampton Roads.**—C. R. Johnson. **Lexington.**—W. J. Turner. **Lorton.**—A. T. Hyde. **Newport News.**—G. C. Allen, C. W. Ashby, S. W. Mosher, J. M. Sexton. **Norfolk.**—R. Coltman, Jr., D. C. Corwin, G. W. Ely, T. W. Hacker, A. A. Raymond, W. L. Saunders, E. H. Sparfield, C. B. Watkins, E. Whedbee. **Penniman.**—E. J. Thomas. **Richmond.**—H. E. Doyle, H. H. George, 3d. **Warsaw.**—T. T. Wright. **Williamsburg.**—C. H. Trask. **Winchester.**—A. M. Field.

**WASHINGTON. Total 20.**

**Bremerton.**—L. F. Bellinger. **Mt. Vernon.**—J. W. Meehan. **Olympian Peninsula.**—H. W. Pattin. **Seattle.**—C. W. Coit, A. S. Downey, L. R. Ellis, F. J. Engel, C. E. Erickson, G. A. Ferguson, C. W. Harris, C. N. Reitze, H. W. Rutherford, A. C. Terrel, W. E. Wilson. **Selah.**—H. C. Brown. **Shelton.**—L. Muller. **Snoqualmie.**—W. J. Ryan. **Spokane.**—H. G. Harrison. **Tacoma.**—H. G. Lanahan. **Vancouver Barracks.**—J. H. Miller. **Yakima.**—E. V. Baron.

**WEST VIRGINIA. Total 11.**

**Charleston.**—J. P. Blundon. **Clarksburg.**—E. T. Brown. **Elkhorn.**—J. M. Lewis. **Elkins.**—E. Drennen. **Grafton.**—F. H. Eisenbrandt. **Huntington.**—H. J. Spelman. **Morgantown.**—R. P. Davis. **Nitro.**—G. A. Stanton. **Parkersburg.**—W. H. Gerwig. **Wheeling.**—A. H. vonBayer, C. E. Crook.

**WISCONSIN. Total 11.**

**Appleton.**—J. B. MacHarg, F. Schwalbach. **Fond du Lac.**—W. W. Gaffin. **Goodman.**—R. B. Goodman. **Madison.**—W. G. Hoyt, D. W. Mead, C. B. Stewart, F. E. Turneure. **Milwaukee.**—J. C. Davis, L. M. Mann, N. M. Works.

**WYOMING. Total 3.**

**Buffalo.**—John H. Rice. **Casper.**—P. Covert, Jr. **Green River.**—I. C. Brewer.

## CENTRAL AMERICA

**NICARAUGA. Total 1.**

**Rivas.**—J. del C. Munoz.

**PANAMA. Total 4.**

**Balboa Heights.**—H. P. Schneck. **Canal Zone.**—L. F. Cianchini. **Corozal.**—H. Ten Hagen. **Cristobal.**—E. W. Eickelberg.

**ARGENTINE REPUBLIC.—Total 3.**

**Buenos Aires.**—M. A. Monge, J. P. Urner. **Cordoba.**—C. C. Lewis.

**BRAZIL. Total 8.**

**Ceara.**—A. E. deM. Froto. **Para.**—D. G. Borges. **Rio de Janeiro.**—E. B. Holmes, J. B. Macedo. **Sao Paulo.**—C. P. Barros, O. M. da Costa, R. Dominguez, A. P. Souza.

**CHILE. Total 3.**

Chuquicamata.—T. D. Sawyer. Raucagua.—E. H. Baldwin. Tocopilla.—A. Diamant.

**ECUADOR. Total 1.**

Quito.—J. A. Gomez.

**PARAGUAY. Total 1.**

Asuncion.—A. B. Cudas.

**PERU. Total 1.**

Pisco.—J. F. Remy.

**WEST INDIA ISLANDS****BAHAMAS. Total 1.**

Nassau.—E. George.

**CUBA. Total 24.**

Camajuani.—E. Hernandez. Cardenas.—J. M. Vizcaino. Central Cunaga.—L. E. Freyre. Central Hershey.—J. B. O'Brien. Central Stewart.—S. M. Yzaguirre. Cienfuegos.—A. Castillo y Grau, F. J. Fernandez. Havana.—F. L. Getman, H. F. Hamlin, A. A. Lacazette, F. Landa, M. G. Menocal, L. Pesant, F. Ponce de Leon, F. deP. Rodriguez, M. A. Rue, L. deSena, C. C. Torrance. La Gloria.—F. J. Ferrer. Manati.—R. Queral. Mariano.—E. R. Williams. Pina.—P. B. Windsor. Santa Clara.—J. M. Campaneria. Santiago.—J. E. Aguilar.

**DOMINICAN REPUBLIC. Total 1.**

J. T. Tavares.

**ISLE OF PINES. Total 1.**

Nuevo Gerona.—L. C. Giltner.

**PORTO RICO. Total 11.**

Aguirre.—J. Hayes. Ensenada.—A. S. Bures, R. Ramirez. Fajardo.—R. Gonzalez, J. A. Zambrana. Ponce.—F. de Porrata Doria. San German.—A. Vioni. San Juan.—A. S. Luchetti-Otero, A. Rodriguez, G. J. Steinacher. Santurce.—F. Pons.

**VIRGIN ISLANDS. Total 1.**

St. Thomas.—B. Friedenberg.

**AFRICA****Total 1.**

Ceuta.—H. Blanco Morales.

**ASIA****CHINA. Total 43.**

Canton.—W. H. Evans. Changsha.—Y. S. Hsu. Foochow.—G. C. Hanson. Hangchow.—E. M. Geible. Hankow.—H. S. Chuck, E. C. Williams. Han Shan-Shien.—H. K. Yen. Kalgan.—K. Y. Li. Luchowfu Anhui.—J. H. Pei. Nan Chang.—Y. Lo. Nanking.—T. C. Hu, M. T. Shen. Ningpo.—C. Y. Wang. Peking.—K. Y. Char, C. S. Chen, T. King, T. T. Lee, R. W. Powell, T. C. Sun, P. Y. Tsai. Shanghai.—N. S. Koo, K. S. Lee, Y. C. Loh, W. E. Patten, H. A. Vanderbeek, N. Z. Zee. Soochow.—C. Y. Hou. Tangshan.—D. F. McLeod. Tientsin.—J. W. Beardsley, M. K. Chen, I. K. Chowang, L. Kampf, W. W. Lau, H. S. Lee, C. Y. Leung, Y. Sun, C. H. Wang, T. Wang, Y. S. Wong. Tongshan Chili.—C. C. Lo. Wusih City.—F. S. Lu. Yochow City.—S. Y. D. Shae. Yungting.—P. H. Chen.

**JAPAN. Total 1.**

Aomori City.—T. Nambu.

**PHILIPPINE ISLANDS. Total 16.**

Iloilo Iloilo.—C. Lopez. Manila.—R. Agcaoili, R. J. Auld, A. Baltasar, M. S. Cacho, F. de la Cantera, M. S. Concepcion, C. H. Davidson, S. Garmez, J. Garrido, A. Gideon, A. Magsaysay, G. W. Mayo, J. Paez, E. Quisumbing, V. A. Tan.

**SUMATRA. Total 2.**

Asahan.—D. E. Andrews, A. J. Edge.

**AUSTRALIA****NEW SOUTH WALES. Total 2.**

Sydney.—W. H. Ledger, S. A. Graham.

**EUROPE****DALMATIA. Total 1.**

Ragusa.—F. E. Lawrence.

**ENGLAND. Total 5.**

C. S. Beck, O. DeCarre, R. L. Hyde, E. G. Kaufmann, T. H. Prentice.

**FRANCE. Total 151.**

G. P. Allen, W. F. Allison, J. A. Anderson, W. C. Anderson, F. C. Ashley, H. Ashton, W. G. Atwood, L. Aull, R. W. Austin, J. S. Bailey, W. T. Ballard, L. F. Balser, M. H. Barnes, H. H. Batjer, I. E. Behrman, O. Bensen, P. E. Bermel, M. M. Bird, C. R. Bliss, C. E. Boesch, P. L. Braunworth, G. E. Brower, J. T. Burton, E. B. Butchers, J. B. Campbell, H. T. Canfield, S. S. Caves, P. T. Coffey, C. L. Corbit, A. B. Cuddeback, E. Cummings, W. E. Darrow, R. M. Davis, W. E. Day, J. DeWitt, A. H. Dimijian, R. S. Dodson, W. D. DuPre, G. D. Ellsworth, Jr., A. A. Fahey, F. V. Fields, T. J. Fleming, H. A. Foster, T. L. Fountain, G. S. Frank, H. H. Frank, W. B.



Freeman, C. P. Frost, W. E. Fuller, S. L. Gatslick, W. Gavett, G. Gordon, R. R. Graham, W. H. R. Haggart, R. S. B. Hartz, W. Harwood, T. S. Hauck, G. M. Heinitsch, S. G. Hess, A. P. Himes, M. Hofstadter, F. E. Holland, H. F. Holloway, Jr., J. A. W. Iglehart, H. Johnson, J. A. Johnson, M. C. Johnson, H. H. Jones, T. F. Keating, Jr., C. K. Kerby, R. T. Kerby, R. T. Kidde, P. King, L. D. Kingsland, F. M. Kipp, D. Lee, E. H. Leggett, L. M. Devine, H. C. Loeffler, H. C. McGowan, N. C. McMath, Y. C. Ma, L. C. Mahoney, G. E. Malone, R. J. Mann, C. A. Maxeimer, R. G. Mead, A. C. Meikle, R. S. Meston, D. N. Milhan, L. J. Mulhearn, F. B. Mullen, A. Mulliken, J. I. Nelson, N. Neumaier, T. T. Newbold, A. D. Newkirk, T. S. Newman, G. R. Ogier, R. Parmenter, J. E. Pennywitt, G. C. Pierce, P. L. Pierce, H. B. Pope, C. F. Radford, J. H. Ramsay, A. M. Randolph, C. Rohwer, J. R. Rosenfeld, A. B. Sanderson, Jr., H. F. Scholtz, C. F. Seifried, F. S. Senior, M. N. Shelton, G. G. Sloane, W. J. Snively, A. M. Snow, J. A. Sourwine, W. E. Spragins, F. L. Stearns, G. V. Steele, M. Stein, J. H. Stevens, F. S. Storey, J. C. J. Strahan, S. Strumer, C. H. Swick, G. R. B. Symonds, R. L. H. Tate, E. H. Taylor, R. Taylor, E. R. Thomas, E. H. Tillotson, F. C. Tolles, R. S. Torrance, J. C. Tunnicliffe, E. Van Devanter, C. A. Volz, N. A. Walbran, L. K. Warner, J. Weathersen, W. L. Webb, C. Weiss, R. D. Welsh, C. S. Whitney, A. F. Williams, H. K. Wilson, C. B. Wing, H. E. Wong, E. A. Wood, Harold B. Wright.

#### GERMANY. Total 12.

A. M. Bowles, B. Goodman, H. L. Hock, R. G. McClure, R. W. Parkhurst, N. S. Perkins, F. W. Roberts, R. C. Russell, W. H. Wales, Jr., J. J. Wall, Jr., H. S. Warner, T. L. Welles.

#### ITALY. Total 2.

G. Miller. Trieste.—W. R. Dillard.

#### NORWAY. Total 1.

S. Rogde.

#### ADDRESSES UNKNOWN. Total 14.

H. V. W. Berry, H. C. Delano, W. R. Doores, J. G. Dorsey, P. G. Douglas, H. W. Gilmore, E. S. Hanna, H. C. Hanson, D. T. Lawson, K. W. McPherson, L. P. F. X. da Silveira, C. R. Stine, S. M. Turrill.

Total Membership.....	1855
Deceased .....	159

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Total Graduates, including those of 1919..... 2014

## DECEASED MEMBERS

NAME	RESIDENCE	DATE OF DEATH
Allen, Charles F . . . . .	CE '73 Denver Colo . . . . .	Feb. 7, 1914
Almeida, M B . . . . .	CE '09 Belle Horizonte Brazil . . . . .	Oct 6 1916
Ames, Willis C . . . . .	CE '77 Whitney's Point N Y . . . . .	Feb 23 1894
Alyen, Charles P . . . . .	CE '76 Aylmer Canada . . . . .	April 1894
Aylen, J . . . . .	CE '77 Winnipeg Canada . . . . .	Oct 19 1916
Beakes, C C . . . . .	CE '16 Sidney Center, N. Y . . . . .	Oct 9 1918
Biersuck, J . . . . .	CE '13 Brooklyn N Y . . . . .	Jan 15 1918
Bowman, D. W . . . . .	CE '72 Miami Fla. . . . .	March 14 1917
Brauner, J F Jr . . . . .	CE '05 Ithaca N Y . . . . .	Sept 4 1918
Breedlove, John C . . . . .	CE '02 St Paul Minn . . . . .	March 10 1915
Brown, Allen J . . . . .	CE '96 Oswego N Y . . . . .	April 7 1903
Bucno, Francisco de A V . . . . .	CE '76 Rio de Janeiro Brazil . . . . .	About 1881
Burns, Justin A . . . . .	CE '92 Watertown N Y . . . . .	Nov 14 1905
Bush, John L . . . . .	CE '08 Utica N Y. . . . .	Oct 21 1916
Cabassa, Hermann . . . . .	CE '11 Mayaguez P R . . . . .	June 30 1911
Canaga, Ira D . . . . .	CE '11 Charleston W Va . . . . .	July 10 1913
Carpenter, Frank De V . . . . .	CE '73 MCE '76 Highland N Y. . . . .	Dec 19 1883
Chapmar, C T . . . . .	CE '00 Rochester N Y . . . . .	Sept 26 1917
Chase, Arthur R . . . . .	CE '05 Sioux City Ia . . . . .	Dec 7 1905
Clark, Dan B . . . . .	CE '93 Newtonville Mass . . . . .	May 20 1904
Clark, Frank B . . . . .	CE '96 Fulton N Y . . . . .	Oct 29 1889
Clark, Ira E . . . . .	CE '72 Weston Mass . . . . .	May 23 1882
Colburn, Dan K . . . . .	CE '72 Woodhull Ill . . . . .	June 3 1914
Conable, Morris R . . . . .	CE '76 Monrovia Calif . . . . .	Sept 15 1907
Cook, C F . . . . .	CE '06 Pittsburgh Pa . . . . .	Jan 1 1919
Cook, Isaac N . . . . .	CE '75 Jersey City N J . . . . .	May 7 1885
Cooper, Edgar H . . . . .	CE '85 New York City . . . . .	Oct 1890
Cooper, Wilfred L Jr . . . . .	CE '10 Bedford Pa . . . . .	July 23 1911
Cornell, Oliver H P . . . . .	MCE '74 Winston-Salem N C . . . . .	Oct 13 1911
Couch, Vinton M . . . . .	CE '91 Odessa N Y . . . . .	Nov 4 1901
Crandall, C L . . . . .	CE '76 Ithaca N Y . . . . .	Aug 25 1917
Curtis, Winthrop L . . . . .	CE '92 Horseheads N Y . . . . .	June 20 1913
Deane, F P . . . . .	CE '08 Buffalo N Y . . . . .	Feb 6 1918
Denham, D P . . . . .	CE '14 Franklin N J . . . . .	Oct 23 1918
Dewar, Robert C . . . . .	CE '09 S Norwalk Conn . . . . .	May 20 1914
Dickinson, Joseph A . . . . .	CE '10 Pueblo Colo . . . . .	May 28 1914
Dimon, Henry G . . . . .	CE '87 New Rochelle N Y . . . . .	Jan 9 1902
Dordaluboff, John A . . . . .	CE '74 Nijni Novgorod Russia . . . . .	About 1882
Dodd, Franklin M G . . . . .	CE '90 Franklin N J . . . . .	Sept 13 1891
Doerflinger, Augustus . . . . .	CE '71 Brooklyn N Y . . . . .	Nov 24 1899
Eidlitz, Alfred H . . . . .	CE '76 New York City . . . . .	April 22 1877
Emerson, H H . . . . .	CE '13 Conneaut O . . . . .	Feb 28 1916
Emmons, Charles M . . . . .	CE '88 Beaver Falls Pa . . . . .	Sept 14 1911
Enos, George W . . . . .	CE '96 Chaumont N Y . . . . .	Nov 3 1905
Ewing, William B . . . . .	CE '83 La Grange Ill . . . . .	April 8 1911

# Deceased Members

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NAME	RESIDENCE	DATE OF DEATH
Fanning, W C . . . . .	CE '16 Leetsdale Pa . . . . .	Mar 10 1919
Farnham, Irving T . . . .	CE '92 West Newton Mass . . . . .	Sept 19 1908
Farnham, Whitfield . . . .	CE MCE '71 '74 St Louis Mo . . . . .	April 13 1895
Fay, Lawrence B . . . . .	CE '06 Washington D C . . . . .	Sept 17 1912
Ferguson, Nicholas . . . .	CE '79 St Louis Mo . . . . .	Sept 22 1896
Fisher, Bertrand A . . . .	CE '85 Sausalito Cal . . . . .	May 27 1906
Fisher, Nathan S . . . . .	CE '99 Norwich N Y . . . . .	Aug 29 1900
Fitch, William R . . . . .	CE '74 Ithaca N Y . . . . .	April 14 1886
Foster, Reuben B . . . . .	CE '74 MCE '77 S Lake Wier Fla . . . . .	Nov 7 1895
Fraleigh, H E . . . . .	CE '02 Saranac Lake N Y . . . . .	Nov 16 1917
Frost, Arthur B . . . . .	CE '01 Ithaca N Y . . . . .	March 7 1902
Frost, Frederick W . . . .	CE '72 New York City . . . . .	Oct 3 1899
Gaston, Louis . . . . .	CE '08 Havana Cuba . . . . .	Nov 28 1908
Geigel, Antonio S . . . . .	CE '92 San Juan P R . . . . .	Jan 17 1901
Gibbs, Harley S . . . . .	CE '98 Pittsburgh Pa . . . . .	Aug 8 1899
Gilbert, Warner W . . . .	CE '95 Rochester N Y . . . . .	May 19 1901
Gillette, Olin C . . . . .	CE '71 Atlanta Ga . . . . .	Jan 25 1901
Green, Rutger B . . . . .	CE '95 Detroit Mich . . . . .	Dec 8 1908
Green, Almon C . . . . .	CE '75 Palmyra N Y . . . . .	July 28 1897
Guinn, John B . . . . .	CE '92 Joplin Mo . . . . .	May 17 1905
Gunner, Daniel W . . . .	CE '87 Schaghticoke N Y . . . . .	Oct 10 1887
Haag, J. M . . . . .	CE '97 Windham O . . . . .	Feb 7 1918
Halbert, Henry D . . . . .	CE '85 San Diego Cal . . . . .	Feb 26 1910
Hallock, E Allen . . . . .	CE '91 Moriches N Y . . . . .	April 13 1900
Hasbrouck, Alva D . . . .	CE '88 Highland N Y . . . . .	July 5 1904
Hasbrouck, Charles A . . .	CE '84 Pasadena Cal . . . . .	Feb 1 1910
Herman, R . . . . .	CE '79 Washington D C . . . . .	Dec 9 1915
Hibbard, Horace N . . . .	CE '74 Ithaca N Y . . . . .	Sept 18 1914
Higley, Anson H . . . . .	CE '99 Syracuse N Y . . . . .	Sept 22 1913
Hitz, Irving . . . . .	CE '91 Chicago Ill . . . . .	Sept 24 1901
Holbrook, Ernest M . . . .	CE '89 MCE '90 Ithaca N Y . . . . .	Oct 9 1892
Holloway, Roger T . . . .	CE '08 Montclair N J . . . . .	March 12 1914
Hulse, Howard C . . . . .	CE '91 Brooklyn N Y . . . . .	Feb 20 1893
Jacobs, J L . . . . .	CE '04 New York City . . . . .	Oct 2 1918
Jones, Stanley R . . . . .	CE '08 Ithaca N Y . . . . .	Aug 1 1913
Jordao, Elias F P . . . .	CE '74 Sao Paulo Brazil . . . . .	March 25 1901
Kerr, James A . . . . .	CE '13 New York City . . . . .	June 28 1915
Key, Da Yong . . . . .	CE '14 Nanking China . . . . .	Jan 1917
Landers, Herbert H . . . .	CE '90 Green Island N Y . . . . .	Feb 4 1893
Lattin, Benton . . . . .	CE '07 Ashtabula O . . . . .	May 2 1911
Law, Harry C . . . . .	CE '08 Buffalo N Y . . . . .	Oct 9 1912
Liu, Zoong D . . . . .	CE '12 Hankow China . . . . .	Oct 1914
Lyman, George F . . . . .	CE '73 Tenaflly N J . . . . .	Dec 25 1880
McClure, Hunter . . . . .	CE '10 Piedmont Calif. . . . .	Sept 26 1918
McConnell, Jacob W . . . .	CE '13 Canton O . . . . .	June 22 1913
McCormick, Cyrus H . . .	CE '78 Riverton Wyo . . . . .	April 17 1908
McCrea, Clark W . . . . .	CE '81 MCE '84 Cape Girardeau Mo . . . . .	Jan 23 1912

NAME	RESIDENCE	DATE OF DEATH
MacMullen, Justus C . . .	CE '76 Unionville N Y . . .	Jan 31 1888
Makepeace, M D . . .	CE '75 Syracuse N Y . . .	
Marrian, R R . . .	CE '15 New York City . . .	Oct 17 1918
Martinez, Christobal A . .	CE '07 Vera Cruz . . .	About Mar 1914
Merrill, O . . .	CE '99 New York City . . .	Oct 5 1918
Mersereau, C V . . .	CE '79 Los Angeles Cal . . .	Dec 6 1917
Moore, Clarence S . . .	CE '98 Olean N Y . . .	July 7 1900
Moore, Harold T . . .	CE '13 Richmond Hill N Y . . .	Dec 26 1914
Moore, H. R . . .	CE '13 Patchogue N Y . . .	Oct 6 1918
Moraes, D C de . . .	CE '77 Sao Paulo Brazil . . .	Dec 15 1917
Mossman, H A . . .	CE '14 Buffalo N Y In France . . .	April 25 1918
Neeley, S T . . .	CE '95 Cape Girardeau Mo . . .	Aug 6 1918
Oettinger, D . . .	CE '14 Washington D C . . .	Oct 7 1918
Page, John . . .	CE '80 Oil City Pa . . .	June 27 1910
Park, Robert B. . . .	CE '94 Athens Pa . . .	Aug 24 1905
Parke, R A . . .	CE '80 Pittsburgh Pa . . .	
Parsons, Frank . . .	CE '75 Boston Mass. . . .	Sept 26 1908
Peck, William T . . .	CE '02 Bristol Conn . . .	Sept 12 1905
Perkins, P H . . .	CE '75 Superior Wis. . . .	
Perkins, R W . . .	CE '14 Springfield Mass . . .	Oct 31 1916
Pierce, Henry . . .	CE '80 Richmond Va . . .	Aug 21 1911
Pitzman, Harold W . . .	CE '06 St Louis Mo . . .	Nov 21 1906
Potter, F H . . .	CE '94 New York City . . .	Jan 7 1916
Pratt, Winslow S . . .	CE '04 Albion N Y . . .	Aug 18 1908
Preston, Edward L . . .	CE '79 Ellensburg Wash . . .	Oct 14 1906
Preston, Erasmus D . . .	CE '75 MCE '80 Washington D C . .	May 8 1906
Preston, Kolce . . .	CE '73 Wilmington Del . . .	Jan 4 1876
Price, Charles S . . .	CE '72 Johnstown Pa . . .	Jan 10 1915
Puffer, L R . . .	CE '14 Hartford Conn . . .	
Rawson, Forrest H . . .	CE '10 Glens Falls N Y . . .	Nov 21 1912
Redmond, Hugh . . .	CE '03 Camillus N Y . . .	Oct 24 1911
Rogers, Jesse A. . . .	CE '91 Evans Mills N Y . . .	April 24 1897
Rommel, Arthur E . . .	CE '02 Oskaloosa Ia . . .	Feb 26 1916
Salmon, Samuel W . . .	CE '71 Mt Olive N J . . .	Aug 7 1910
Seabury, A H . . .	CE '95 Hempstead N Y . . .	Sept 13 1915
Seelye, Edward E. . . .	CE '08 St George S I . . .	Nov 8 1912
Seidell, William C . . .	CE '04 Peterboro N Y . . .	Dec 28 1904
Shaler, Ira A . . .	CE '84 MCE '86 New York City . . .	June 29 1902
Sheldon, Daniel C . . .	CE '83 Delphi N Y . . .	Oct 2 1893
Shepard, Frank W . . .	CE '86 Medina O . . .	Feb 10 1892
Sherman, Frederick E . .	CE '07 Watkins N Y . . .	March 8 1909
Shuttleworth, Frederick W.	CE '10 Albany N Y . . .	April 13 1911
Sill, Cyrus B . . .	CE '72 Edinboro Pa . . .	Sept 30 1908
Sill, J M. . . .	CE '11 Detroit Mich . . .	Jan 22 1919
Simpson, George F . . .	CE '79 New York City . . .	April 23 1915
Smith, George LaT . . .	CE '71 MCE '74 Canandaigua N Y . .	June 25 1892
Smith, William J . . .	CE '79 Charleston N Y . . .	Dec 3 1886

NAME	RESIDENCE	DATE OF DEATH
Spafford, J H . . . . .	CE '17 Baltimore Md . . . . .	Oct 9 1918
Spielman, C . . . . .	CE '15 Brooklyn N Y . . . . .	Oct 11 1918
Stewart, Neil Jr . . . . .	CE '87 York N Y . . . . .	March 30 1891
Stolp, Myron G . . . . .	CE '72 New York City . . . . .	Mar 5 1906
Storey, Frank B . . . . .	CE '10 Rochester N Y . . . . .	April 21 1915
Sugi, Bungo . . . . .	CE '90 Tokio Japan . . . . .	Fall of 1913
Tatnall, George . . . . .	CE '75 Wilmington Del . . . . .	Sept 13 1906
Terhune, E Stanley . . . . .	CE '09 Newark N J . . . . .	Nov 8 1918
Tibbetts, Addison S . . . . .	CE '77 Lincoln Neb . . . . .	Sept 25 1915
Tiley, George . . . . .	CE '73 Washington D C . . . . .	March 14 1877
Tompkins, John H . . . . .	CE '73 Poughkeepsie N Y . . . . .	July 1897
Toms, J W . . . . .	CE '09 Davenport Ia . . . . .	Dec 20 1918
Tracy, W H . . . . .	CE '05 Albuquerque N M . . . . .	May 1918
Turner, K B . . . . .	CE '03 MCE '05 Ithaca N Y . . . . .	Oct 21 1918
Van Cauteren, Emile A . . . . .	CE '97 Pringy Seine-et-Marne France . . . . .	July 4 1898
Viegas-Muniz, Joaquin . . . . .	CE '77 Pirocicaba Brazil . . . . .	About 1883
Watson, George B . . . . .	CE '12 Grandmere Quebec Can . . . . .	June 27 1915
Whitlock, E M . . . . .	CE '10 San Francisco . . . . .	Sept 26 1918
Wightman, Williard H . . . . .	CE '81 Ashland Ore . . . . .	Oct 29 1889
Wolkowski, Alex I . . . . .	CE '07 Suwalki Russia. . . . .	Sept 27 1910



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## Civil Engineers and Others

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